

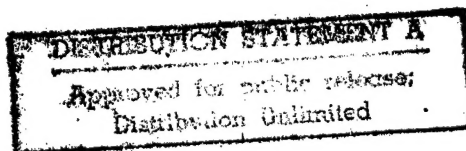
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# East Europe Report

SCIENCE AND TECHNOLOGY



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23 January 1985

## EAST EUROPE REPORT SCIENCE AND TECHNOLOGY

### CONTENTS

#### BULGARIA

New Developments in Robotics, Computer Technology Described (RABOTNICHESKO DELO, 9 Nov 84) .....	1
New Personal Robot, by Milena Dimitrova British Interest in Bulgarian Robotics New Microcomputer Produced, by Aleksandur Yavrichev	
New Laser Developed (SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE, No 4, 1984) .....	6
Bulgarian Academy Achievements, Problems, Future Tasks (Blagovest Sendov; SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE, No 4, 1984) .....	8
State of Arable Land, Erosion, Soil Quality Assessed (Ivan Gurbuchev, Mikho Yolevski; SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE, No 4, 1984) .....	33

#### GERMAN DEMOCRATIC REPUBLIC

Ultrasonic Vibration Welding Equipment Developed (Reinhard Fiedler; BERLINER ZEITUNG, 3-4 Nov 84) .....	47
--	----

#### HUNGARY

Developments in Prostaglandin Production Noted (Istvan Palugyai; MAGYAR HIREK, No 22, 27 Oct 84) .....	50
---	----

#### POLAND

Problems, Difficulties in Robotization Program Described (Andrzej Dubina Interview; PRZEGLAD TECHNICZNY, No 37, 9 Sep 84) .....	52
---	----

NEW DEVELOPMENTS IN ROBOTICS, COMPUTER TECHNOLOGY DESCRIBED

New Personal Robot

Sofia RABOTNICHESKO DELO in Bulgarian 9 Nov 84 p 4

[Article by Milena Dimitrova: "I Am Robko 9"]

[Text] "Hello!" the robot's electronic voice stops me immediately at the door of the laboratory. "I am the Robko 9 personal robot. I have been developed at the Bulgarian Academy of Sciences Institute for Technical Cybernetics and Robotics, with the collaboration of the State Committee for Science and Technical Progress."

Such a kind welcome! Then Robko 9 comes closer, as if to shake its mechanical hand to greet me. The artificial sound is understandable, pleasant, and designed not to bother the ears. The robot quickly wins over its new acquaintances by "singing" them a few songs. They have not been recorded on a tape: the sequence of words and the melody are simply built into its memory.

The voice comes from a body which is not very large--it is in the form of a cylinder and has turning sensors. The head, sensors, and hands can move almost in a complete circle, bend, contract, change positions. The gripper, which replaces the hand and fingers, opens and closes remarkably well. It even has a program which allows Robko 9 to fix and serve a cup of coffee with its mechanical hand . . .

What else can it do? The permanent memory has over 100 official sub-programs. They can be used independently or combined for educational purposes. High school students as well as college students and specialists can develop their creative abilities with its help. Several dozen commands are also already "loaded," which makes two-way communication, dialogue between man and machine, easier. One special plate, which is regulated by the central processor, synthesizes syllables and in this way reproduces speech. The robot "expresses itself" in Bulgarian and in English according to a previously prepared combination of phonemes. It can also be directed by written numerical programs. It includes a clock and calendar, for coding tasks that have to be carried out. The creators have foreseen a modular construction, through which they could add to and extend its possibilities.



Do these factors not resemble science fiction?

In the technical specifications for the Robko 9 we also read: "It can be used to conduct complex scientific experiments together with the Pravets 82 microcomputer. The Robko is able to carry out various transportation and manipulation operations under conditions which would be dangerous for the life and health of humans. It is designed for instruction and acquisition of scientific and professional knowledge in various fields."

The name of the whole family, "Robko," is taken from the first letters of the words robotized computer system. And the Robko 9 is the first experiment in our robotics, the first mobile device which was created not for industrial use, but for teaching and everyday life. It "feels" best in a school, at home, or in an office. It can be used as a watchdog, it guards rooms, notes changes, reacts to them: it calls and notes what time something has happened.

We jokingly asked the robot to find the brightest spot in the laboratory. Just like Zen in the television series, but with the help of the operator, Robko 9 turned its sensors to the window. We put a table in the way of the machine, on its previously determined path. It "noticed" it! It stopped and went around it.

In a way it is funny and absurd to ascribe human characteristics to it, and to seek artificial intelligence from a robot. It does not possess them yet. Behind its imagined mind stand electronic elements, diagrams, apparatuses. Even the examples pointed out are explained with sensors.

The majority of the structural elements in the Robko 9 are Bulgarian. The novelty, which is protected by patents, is a keyboard with 16 keys, which merely by being touched will load, check, and demonstrate programs. It has been developed in cooperation with the Bulgarian Academy of Sciences Central Laboratory for Photoprocessors.

But if there is anyone we should admire or reward with a kind word it is the achievements of its creators. At the Adaptive and Robotized Systems Laboratory they have shared the news that the developments of Bulgarian robotics can be applied not only to professional, industrial robots and systems. At the institute they are already working on a series of so-called "teaching robots." These are small, unpretentious robots which are not dangerous at the workplace. In combination with personal computers, they will offer the possibility for our young people to train themselves to be future builders, operators, adjusters, installers, and generally to be masters of Bulgarian robotics.

Before the end of this year, the first Robko 9-type robots will "set off for schools" in the capital and the Mathematical Gymnasium in Plovdiv. The variety of the Robko 9's capabilities, skills, and programs give it a place among the pioneers in world teaching robotics.

"I know that soon," says scientific associate Nedko Shivarov, "perhaps after only a few years, the surprise and the proud job which Robko now evokes will have been forgotten. Robots will astound us with ever newer feats and 'talents.' But we will tenderly turn to that one recent fact: at the fair in Plovdiv, the Robko 9 (with the help of the operator) approached, stuck out its automatic arm and hand, grabbed its prize in its gripper, and dissolved into electronic laughter:

'Ha-ha! I have a gold medal! They gave me a gold medal! Ha-ha! I am Robko 9, a personal robot . . .'"

Actually, it sounded a little like "medail," not "medal." This is because the "syllable" was used as the basic device for synthesizing human speech! And this is precisely one of the outlined purposes for which scholars at the Bulgarian Academy of Sciences Institute for Technical Cybernetics will continue their creative efforts.

#### British Interest in Bulgarian Robotics

Sofia RABOTNICHESKO DELO in Bulgarian 9 Nov 84 p 4

[Article: "Justified Interest in England"]

[Text] For 4 years now Bulgaria has been exporting planetary substance delivery devices for welding, the IZAPLAN, to England. These have been constructed by scientists at the Bulgarian Academy of Sciences Institute for Technical Cybernetics and Robotics. The constant delivery of substances is made possible by means of planetary specialized rollers, which revolve around it. On the way to perfecting the item for the first generation, a whole range of the following models was created: IZAMETRIK, IZAMODUL, and POLIIZAPLAN, in which a number of English firms have shown great interest.

The following fact speaks about the interest in the Bulgarian planetary substance delivery welding devices: at the Weldex-83 international exhibition of welding technology, conducted at the ES national exhibition center in Birmingham last year, one of the largest English firms, General Electric, demonstrated for the visitors its welding robots, with the IZAMODUL planetary substance delivery devices.

Interest in our items is also manifested by such well-known giants of machine building and electronics as Lansing Bagnal, a firm that produces hoisting and transporting machines and welding robots; ASEA Lincoln Automation, the English branch of the Swedish ASEA firm, which produces and sells welding robots and technological lines; Philips, the producer of electrotechnical and welding equipment; the American firm ST International, and a number of others.

An indicative fact is that five Bulgarian substance delivery devices are at work in the scientific laboratories of the largest specialized higher education institution in London, the Welding Institute, for instructing

students in the specialties of welding technology and welding machines. The names of firms and enterprises which are using Bulgarian planetary welding machines are many. The affirmation of the prestige of the Bulgarian brand is due exclusively to the high qualities of the machines, to their competitive abilities on the world market. They respond best of all to the world requirements for high quality, high technical-economic and utilization indicators.

#### New Microcomputer Produced

Sofia RABOTNICHESKO DELO in Bulgarian 9 Nov 84 p 4

[Article by Aleksandur Yavrichev: "The IZOT 1031 S Microcomputer"]

[Text] I had to wait for the builder responsible for the IZOT 1031 S microcomputer, engineer Aleksandur Subotinov, because specialists from the Lenin Higher Machine Electrical Institute had arrived at the Elektronika factory in Sofia to pick up the item. Thus, without having asked, I got the answer to my first question: Has the microcomputer been adopted for production? Several minutes later engineer Subotinov explained proudly: "We have complied with the state task ahead of time: we have implemented the basic model in regular production a whole month early. And the next variant, the IZOT 1031 S.01, will be introduced into production 9 months ahead of the deadline laid out in the plan for the IZOT State Economic Combine."

Such rapidity is easily explained. The national economy needs many personal computers. Just a few days ago the resolution of the Politburo of the Central Committee of the Bulgarian Communist Party guaranteeing the comprehensive conditions the young people to train and work with computer technology was published. But personal computers are needed for scientific institutes, industry, transportation, agriculture, trading and service industries, etc. As we see, the areas of application are quite varied. Will the personal computer become a panacea for all problems?

Looked at generally, personal computers have been rising, as they say, on the crest of a wave in computing technology in the last several years precisely because of their universal applicability. It is enough to say that they do not require special working conditions, climatic installations, for instance, which are needed by their "brothers," the mid-sized and large computing machines. Personal computers can be installed in offices, in shops, in laboratories, and the smallest types can be fit into a diplomatic briefcase for use while traveling. Another substantial advantage is that no special education is needed to work with it. It is well known that in the classic example, the mediator between the consumer and the computer is the operator, with his special training. Now this intermediary is removed, and the consumers "communicate" directly with their personal computers. And finally, it is not insignificant for mass practice and circumstances that the microcomputers are much cheaper than the mid-sized and large computing machines.

These advantages have been wholly related to a concrete example, the IZOT 1031 S microcomputer. It has rightly been called universal, because this epithet fully defines the broad palette of spheres of application: economics, planning, administrative services, education, scientific research, control and management of processes, data processing, etc. The microcomputer was created by the Central Institute for Computer Technology in Sofia, by a collective led by scientific associate engineer Vladimir Chilov. The basic model, IZOT 1031 S, has an 8-bit micro-processor, 64K operating memory, alphanumeric keyboard, which permits work in the Cyrillic and Latin alphabets, a built-in monitor, on whose screen information can be shown in four formats, an external memory with two storage devices, using mini-floppy magnetic disks. In addition to this, another video monitor can be attached to the microcomputer, as far as 300 meters away, as well as an ordinary cassette recorder. The IZOT 1031 S uses the BASIC programming language, which is easily learned by the consumer, and 2 types of ASSEMBLER. In future models of the microcomputer, languages at a higher level, such as FORTRAN, PASCAL, etc., will also be usable.

A normally painful question about any new product is the base of elements. Each item imported from abroad presents the producer with many unknowns. In this case we can say joyfully that many of the elements are Bulgarian, and the others are produced in socialist countries. Another substantial advantage is that the microcomputer does not require any special software; it can work and is compatible with the items which our industry is already producing.

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## NEW LASER DEVELOPED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE No 4, 1984 p 107

[Article: "PBL-01 Autonomous Readjustable Dye Laser"]

[Text] The laser was created at the Institute for Electronics at the Bulgarian Academy of Sciences according to the basic principle resolutions of the electrical and optical design for readjustable lasers, protected by four inventions (registered under numbers 30141/1975, 35781/1979, 49771/1980, 53348/1981). Invention No 49771, a readjustable laser, was made in cooperation with the Bulgarian Academy of Sciences Institute for Electronics and the Photophysics Laboratory at the National Center for Scientific Research in France. It is protected by patents in the USA, West Germany, the GDR, the USSR, Czechoslovakia and Hungary, with the purpose of licensed sales of the invention. M. Nenchev, scientific associate and candidate of physical sciences, is the leader of the design team.

The PBL-01 autonomous readjustable dye laser is a multifunctional readjustable laser of a liquid dye solution, stimulated by rarified gas pulsating lamps. Its design permits realizing different versions: linear resonator, circular two-way and one-way resonators undulatory configurations. It is possible to introduce various types and systems of spectral selectors and line selections of different widths. The capability of generating two independent readjustable frequencies into one outgoing beam has been included. The readjustment of the laser is done in the red, yellow, and blue spectra. The maximum outgoing energy is 100mJ; the duration of the impulse is 5-7  $\mu$ s. The maximum frequency of repetition of the impulses is 1 Hz; the nominal frequency is 0.3 Hz. The PBL-01 laser can work the broad spectrum generating mode -3nm, and in the narrow strip generating mode ( $2 \cdot 10^{-1}$ nm to  $2 \cdot 10^{-2}$ nm). According to the basic technical parameters, the laser stays significantly above the improved commercial devices of this class, for example, the LZHI-1, with a 0.02 Hz frequency of repetition and maximum outgoing energy of 20mJ, which is close to the LZHI-3 or Electrophoton, with 0.5-0.2 Hz frequency of impulse repetition and 500mJ maximum outgoing energy; it has the advantage of possible two-wave generation.

The laser is designed for application in biological and medical research, for a spectrum-selecting effect on biological targets, spectral optimization

of the therapeutic effect of laser radiation, research on biostimulation of seedling germination, application in systems for remote and local control of dangerous gas pollutants in the atmosphere, in laser spectroscopy, photochemistry, and physics research.

The PBL-01 laser has been implemented at the Bulgarian Academy of Sciences Institute for Electronics. An operating device has been developed, which allows the performance of specialized services. The Medical Academy, the Agricultural Academy, the Committee for Environmental Protection, and others could be potential users of lasers. The Institute for Electronics is ready to develop laser models for the needs of different organizations as well. In addition to the technological effect, the implementation of the PBL-01 laser achieves an economic effect in terms of saving hard currency which would have been needed for the importation of similar devices from abroad.

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BULGARIAN ACADEMY ACHIEVEMENTS, PROBLEMS, FUTURE TASKS

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 4, 1984 pp 5-26

[Article by Academician Blagovest Sendov: "Presentation of Bulgarian Academy of Sciences Report on Its Activity in 1983"; "under this rubric we are publishing in abbreviated form the materials of the Annual Meeting of the Bulgarian Academy of Sciences, which was held on 9 March 1984"]

[Text] The year under review, 1983, was strenuous and fruitful for the BAN [Bulgarian Academy of Sciences] and for all the Bulgarian people. The only academy in our country with its tasks and functions, it linked its activity quite closely with the problems that the Bulgarian people and the Bulgarian state are solving. BAN activity during the period under review was guided by the decisions of the 12th Congress of the Bulgarian Communist Party and by the theoretical formulations and practical approaches developed after the congress by the general secretary of the party, Comrade Todor Zhivkov.

The General Assembly of the Bulgarian Academy of Sciences for reports on the past year was held just before the National Party Conference devoted to quality. The academy participated actively in preparations for the National Party Conference, joining in fulfillment of the tasks assigned by Comrade Todor Zhivkov at the Varna Conference in May 1983.

The Bulgarian Academy of Sciences has its specific place and, in many respects, an indispensable role not only in solving many other problems confronting our country, but also in attacking the problem of quality enhancement. This place and role are determined by the unique interdisciplinary character and high scientific competence of the academy, which have been built up patiently and preserved over the years as a national resource. We all know that this national resource was preserved and expanded following the April Plenum, to be today the scientific bulwark of party and state.

What is the role of the Bulgarian Academy of Sciences in the solution of the quality problem, this--in Comrade Todor Zhivkov's words--fateful problem for our people?

This question was discussed repeatedly during the year under review. Many considerations were voiced; many measures were taken. Comrade A. Balevski recently expressed the academy's very synthesized attitude towards the quality problem



in the words, "To have quality, you must have high-quality people." Our academy begins the solution of the quality problem with the creator of this quality --man. It is in this area that the activities of the academy's social-science institutes mainly take place.

The Bulgarian Academy of Sciences is well known both to our friends and to our enemies as a zealous defender of scientific truth about the history, the language and all the cultural values of our people. Our people, and especially our youth, must know and be conscious of the deep roots from which they spring. The academy's wide activity in the study of Bulgarian history, Bulgarian language, Bulgarian folklore and numerous publications along these lines contribute to the molding of the Bulgarian's self-esteem and responsibility. We are not ashamed to be called Bulgarians. We are proud, just as Georgi Dimitrov was proud, to be sons and daughters of the Bulgarian people. What we must now overcome is the unpleasant ring of the expression "Bulgarian work" as a synonym for something second-rate.

For this purpose not only new materials and new technologies are needed. For this purpose are needed, first and foremost, high-quality people, citizens of socialist Bulgaria. The Bulgarian Academy of Sciences, which works in close harmony with the Kliment Okhridski Sofia University, is aware of its responsibility and sees its tasks along these lines. They are the fundamental problems for the improvement of production quality.

It is not necessary to justify the role of the individual formal sciences in production quality. From scientific information and knowledge of the latest achievements of world science to the automation of scientific experimentation and the robotization of production, the role of the scientist is of special importance everywhere. During the period under review the Bulgarian Academy of Sciences strove to raise the effectiveness of its work in this regard. International scientific cooperation was improved; the administration of scientific research activity was bettered; and the role of an academy-wide strategic planning perspective, reflected in the forecast of fundamental research up to the year 2000 and in the preparation of the plan for the Ninth 5-Year Period, was elevated. Work was also done to improve the organizational structure and technical facilities of the academy's administrative activity, etc.

In 1983 the academy achieved significant results in the fulfillment of its principal function--the development and coordination of fundamental research in the country. Fulfillment of the National Interdisciplinary Program was directed towards the study of current scientific problems and the scientific backup of strategic lines of scientific and technical progress in our country.

At the same time, during the period under review the practical and applied function of the academy, which has gained recognition in recent years, continued to develop. The BAN's integration contacts with sectors and regions of the country were intensified. Contacts with other academies and higher educational institutions were strengthened. The content and forms of international multilateral and bilateral scientific cooperation were augmented. There was significant progress in the fulfillment of 10 joint interdisciplinary specific programs with the USSR Academy of Sciences. The social program of the BAN



staff, stemming from the decisions of the December (1972) Plenum of the BCP Central Committee, was successfully fulfilled.

I shall dwell briefly on some individual activities in our academy during the period under review.

The activity of the Presidium, the Presidium Bureau and the Scientific Secretariat in 1983 was directed toward more effective fulfillment of their supervisory functions as organs of the General Assembly. Their attention centered on problems of an academy-wide character in strategic scientific directions and on problems of the joint centers. The BAN scientific-research program in energetics was approved, as were the Comprehensive Program for Priority Fundamental and Applied-Scientific Research on Development of the Food Complex in the Bulgarian People's Republic up to 2025, the Long-Term Comprehensive Seismology and Seismic Construction Program, the Forecast of Scientific Research in Our Country on Natural Biological Reserves, and the Comprehensive Program for Development of the Economics Institute.

Papers were discussed and decisions made regarding the development of scientific research on the component base of electronics, the intensive opening up of mineral resources, the development of the mathematical principles of computer technology and informatics.

Actively employed in the Presidium are the Special Research Council on "Man and His Environment" and special research councils on the material and technical base, on biological resources and on social sciences. The activity of the Special Research Council on New Materials and Technologies was also improved. Special research councils were set up on new and interdisciplinary lines of inquiry, on biotechnologies, on colloids, on physicochemical mechanics and biophysical chemistry. The memberships of most of the special research councils were renovated and the Special Research Council on the Food Complex became a joint organ of the BAN Presidium and the Agricultural Academy so that closer cooperation could be achieved between the two academies in the area of biological research.

The role and significance of the special research councils not only in long-term planning, but also in forecast activity are increasingly gaining recognition.

During the period under review considerable work was done to improve integration with the Kliment Okhridski Sofia University. This question was discussed at a joint session of the BAN Presidium with the University's Academic Council. Practical measures were mapped out, on the basis of which regulations governing integration between the Bulgarian Academy of Sciences and the Kliment Okhridski Sofia University were drawn up.

Questions regarding the organization of the fulfillment of the BAN tasks stemming from party and governmental documents and from the science plan held a central place in the activity of the Presidium Bureau and the Scientific Secretariat. The BAN adopted a program for work with young people and the Komsomol, as well as measures for BAN participation in work to improve product quality.

Measures were taken for the development of paleomagnetic research, research on plant and animal resources in the Bulgarian People's Republic, on problems in marine and ocean research, etc. Coordination programs were adopted for the application of the KAMAK system, for the development of psychological research, etc. The Presidium Bureau and the Scientific Secretariat were systematically at pains to improve international cooperation and to orient it more directly towards the solution of questions in the academy's plan of scientific research activity. The BAN's work was examined in detail in the Commission on Cooperation with the USSR Academy of Sciences; measures were taken to promote our participation in international nongovernmental organizations. The international activity of the History Joint Center, the status of work in the International Cooperation Sector of the Presidium of the Bulgarian Academy of Sciences, etc., were discussed.

The Presidium, the Presidium Bureau and the Scientific Secretariat worked in close cooperation with the Party Committee, the Union Committee and the Administrative Committee of Komsomol, with which a number of joint sessions were held. Considerable assistance was rendered by the Committee for State and People's Control and the integrated control system of BAN.

During the year improvement of the academy's structure continued with the object of more rational functioning and more specific supervision of several new long-term scientific and applied-scientific lines of inquiry. A Kinetics and Catalysis Institute and an Applied Mineralogy Institute were set up, their tasks and activity being significantly expanded. Partial changes in the structure of sections and other internal elements of institutes were made in almost all joint centers and trusts.

Work to improve the administrative structure of joint centers, scientific trusts and institutes of the Presidium of the Bulgarian Academy of Sciences is also under way in accordance with Decree No 44/1983 of the Council of Ministers.

The activity of the supervisory agencies of the academy during the period under review proceeded in close contact and cooperation with the Science and Education Department of the BCP Central Committee, with the BCP City Committee and the BCP Lenin Rayon Committee. Liaison was also regular and operational between BAN governing bodies and the State Committee for Science and Technical Progress, as well as between their executive bodies for the solution of long-term and current organizational and administrative problems.

The principal activity on which we are reporting today is fulfillment of the plan for scientific research activity of the BAN and Kliment Okhridski Sofia University for 1983.

In 1983, altogether 2664 problems were studied as against a targeted 2622. In respect of this quantitative indicator, the plan was 102 percent overfulfilled.

The bulk of the problems and assignments studied were from the National Integrated Fundamental Research Program. There was a considerable volume of assignments to back up scientific and other national integrated programs for scientific and technical progress.

The report reflects the results of the activity of the Bulgarian Academy of Sciences and Kliment Okhridski Sofia University that made a theoretical and applied-scientific contribution. The specific contributions were numerous and diverse. It is impossible to enumerate them here. An overall assessment of all scientific and applied-scientific results obtained in the BAN-Kliment Okhridski Sofia University system was made in the detailed reports of the joint centers and scientific trusts, accepted at the relevant general assemblies.

Analysis of the reports of the joint centers and independent scientific organizations shows that the 1983 scientific research plan of the BAN and Kliment Okhridski Sofia University was successfully fulfilled. Significant fundamental and applied results were obtained in the area of the natural and social sciences that will affect social practice and the development of science.

Over 65 percent of the problems in regional programs focused on the solution of questions about the quality and efficiency of the output produced in the okrugs.

At the 12th Congress of the Bulgarian Communist Party the academy pledged to make an economic contribution of 520 million leva during the entire Eighth 5-Year Plan. As a result of all its activity in the area of scientific and technical progress, it has, in 3 years of the 5-year plan (1981-1983), made a documented economic contribution amounting to 350 million leva. In 1984 this contribution will increase to more than 410 million leva. Although immediate economic results are not the main object in the BAN's activity, the successful fulfillment of this pledge thus far is a source of pride for our large staff.

During the year the BAN also successfully fulfilled tasks of bilateral and multilateral cooperation with the fraternal socialist countries, this cooperation being most extensive and fruitful with the scientific institutes of the Soviet Union. During the present 5-year plan 42 integrated programs are being studied with the USSR Academy of Sciences alone. The most striking examples in this regard are cooperation with the Joint Nuclear Research Institute in Dubna, participation in the Interkosmos program, the extensive introduction into the industry of the socialist countries of our electroplating processes, exports of machinery and equipment for pressure casting, etc.

Apart from the results achieved, we must note, however, that all the opportunities for achieving still greater effectiveness of scientific research work were still unused. The task now is to discover and make use of the latent reserves during the remaining 2 years of the 5-year plan.

The supervisory organs of the Bulgarian Academy of Sciences and the heads of the joint centers and independent scientific organizations, in closest cooperation with party, trade-union and Komsomol organizations, face the crucial task of providing the necessary conditions--material, scientific and organizational, political--for the successful fulfillment and overfulfillment of the planned goals for the current year--1984--which is decisive for fulfillment of the 5-year plan. At the same time, a number of important and urgent scientific and organizational problems must be solved, namely:

1. The basic function of the Bulgarian Academy of Sciences is to develop and coordinate fundamental scientific research in our country. Modern social production cannot develop or even exist without a constant influx of results from science. Therefore the demand for scientific assistance must be intensified and expanded. But the motive forces in sciences are not limited to concrete applications. To some it may seem paradoxical, but the most intense and effective applications of science come from discoveries which are a result of scientific quests following the logic of science rather than the logic of immediate applications. This is easy to explain. Research which aims at the discovery of new laws and phenomena in nature and society can lead to previously unsuspected applications. This is not science for the sake of science, but science developing in accordance with the inner logic of science which leads it to fundamentally new applications.

Therefore, a fundamental task of the academy is to ensure the possibility of financing--and, what is more, seriously financing--scientific research without prior planning of its applications. The planning of applications is in fact impossible. For such research a special fund must be set up under the Presidium and the chairman of the BAN. First steps in this regard are already being made.

We lay stress on this question since we talk a great deal about this guided fundamental research, which is financed and of great benefit, but for the academy remains new territory which must not be forgotten.

2. The fundamental function of the Bulgarian Academy of Sciences also includes work on the aforementioned basic research. The term "guided fundamental research" is applied in practice to the academy, thanks to our chairman Academician A. Balevski, who has given one of the best concrete examples in this regard with his method of pressure casting.

The guided fundamental research of the academy's institutes must meet a large part of our contracts with individual ministries and okrugs. The machinery for the organization of this research must be improved in order to increase its effectiveness. In the forefront in this regard are problems of new materials, new energy sources, the component base of electronics, the sensor industry, etc.

3. The academy must organize direct production of materials, instruments and other items that result from the activity of its institutes. For this purpose KTB's [design technology offices] and pilot plants, as well as individual small enterprises, must be set up. This question has been placed on the agenda, and its solution will begin during the present year.

Related to this is the question of the trading activity of the Bulgarian Academy of Sciences. The efforts of the governing body of the BAN throughout the year under review to create the academy's foreign trade organization resulted in a decision which will be implemented in the next few weeks with the establishment of BANIMPEX.

4. The training of young scientific personnel is a basic task of the Bulgarian Academy of Sciences which can be successfully performed only in close

integration with the Kliment Okhridski Sofia University and in cooperation with other higher educational institutions.

The question of postgraduate work must be raised again. The regulations now in force are those issued by the State Committee for Science and Technical Progress, according to which a new postgraduate student is accepted if a permanent staff position is guaranteed for him. What does this mean? It means the end of the competitive principle in the appointment of young scientists. Moreover, highly qualified specialists with candidate's or even doctoral dissertation must go into production, administration and secondary schools. Postgraduate work is not just for the training of theoretical scientific cadres.

The number of postgraduates in the BAN-Kliment Okhridski Sofia University complex must be increased several fold in order to bring about the normal reproduction of scientific cadres. To be sure, only a small portion of these postgraduates remain afterwards in the academy or in the university.

5. The problem of physical facilities is unchanged even now. The level of the capital-per-staff-member ratio is an objective measure of the potentialities of the scientific front. The governing body of the BAN sees a possibility of pushing forward on this question through the undertaking of serious investments on the part of the interested ministries, through the setting up of joint laboratories and development centers and through the building of laboratories in BAN territory with resources of the ministries. This must come as a result of our joint programs with the sectorial ministries.

Along these lines also are the building of physical facilities of the academy in the okrugs and the setting up of branch organizations. Most hopeful so far is our experiment with Plovdiv Okrug and our plans for it are most optimistic. Efforts along these lines must continue.

6. Last in the series, let me mention the task of improving the academy's administration. Administrative tasks that must be accomplished this year are as follows: formulation of a comprehensive program of fundamental research in the Ninth 5-Year Plan and up to 2000 with the participation of the Kliment Okhridski Sofia University and other academies and higher educational institutions; preparation and adoption of a new Charter of the Bulgarian Academy of Sciences and improvement of the academy's normative foundation on the basis thereof; devising of specific modes for application of the economic mechanism in academic scientific organizations.

For accomplishment of these tasks the principles of democracy must be applied more fully, the powers of the joint centers must be increased and the elective principle must gain still fuller recognition.

The Bulgarian Academy of Sciences with dignity reports another year in its 115-year history. Today we can say that many things may take place without the assistance of the Bulgarian Academy of Sciences, but with its assistance they will be better and of higher quality. Therefore, let us invest all our energies so that our academy will become strong, our science will grow to maturity and we will greet with honor the 40th anniversary of the socialist revolution in Bulgaria.

## Comments\*

Prof Georgi Yolov

The full text of the report, however schematic it may be, unquestionably shows BAN's activity and the results thereof during the past year to be up to a comparatively good level. At the same time, both in the text and between the lines, as they say, there can still be seen a deep line of demarcation between the individual sciences and scientific spheres. This is not so strange, for Lenin used to remind us that the basic goal of the individual science is to parcel out reality and stake out the range of spheres and problems it will study with its own methods and resources looking to their most thorough interpretation.

I should like to touch from a psychological viewpoint on several problems in intra- and interdisciplinary research. It is probably precisely in this sense that we must direct our attention to the individual attempts, both in our country and abroad, made by scientists who in recent years have joined in combining their efforts in most unusual areas such as, for example, medicine and technology, physiology and cybernetics, and recently both psychology and astronautics. From this viewpoint the question rises again of man's place and fate under conditions of revolutionary scientific and technical changes.

From the perspectives of psychology I want to bring another fact to your attention. Studies have recently been made in our country of large-scale industrial accidents and it has been quite accurately ascertained that these accidents usually occur in the afternoon hours and at the end of the working day. Very often large-scale industrial accidents occur on and after holidays, as well as during annual vacations. Similar research has also been conducted in Moscow in the sphere of public transportation with exactly the same relationships discovered between the human factor and machinery. Obviously, human fitness for work, apart from its mental capacity, also has its physiological capacity. There has also been talk recently of the biorhythms of the human organism as a serious prerequisite for labor intensiveness.

Unfortunately, both in our country and abroad there is no research that will combine into a whole the man-machine interaction. And it is in precisely this sense, I think, that when we prepare to plan scientific research activities in the coming 5-year plan, a fundamental study can also be planned, through the participation both of specialists and the methods and approaches of the different scientific spheres, of the human factor under conditions of present-day scientific and technical progress.

When a question arises of human attitudes and interrelationships under the conditions of science and technical progress, another factor also comes to light. Usually it is designated as man's tolerant attitude toward machines. I say this because we have already become used to speaking of the humanization of

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\*We print the comments in abbreviated form.



machines as a necessity of our times. But recently something else is also noted, namely, that we must, so to speak, humanize man himself in relation to machines, i.e., growth of the personality in its contact and interaction with the machine is indicated. In this area a wide range of problems is revealed, which, in my humble opinion, are absent from the plans and orientations of the scientists.

I should like to raise yet another question as an impression from the report, namely, a question about the fulfillment of the social program for the development of the staff of the Bulgarian Academy of Sciences. The report notes that sufficient or insufficient things have been done in the area of construction, health care, vacations, and especially food service. There is still, let's call it a "blank spot" on the subject of human relationships, about the climate, about tolerant interactions in the cooperation of people on teams and between them. It would be worthwhile analyzing the sphere that we call conflict, clash, disagreement, etc. It is precisely in this sense that I conclude with a proposal: Could an attempt be made to go into this sphere of our analyses also, for it is not unimportant. If some head does not want to take into account the degree and character of the interrelationships in his team, this does not mean that the team does not discuss them, does not comment on these very interrelationships since they affect all team participants.

Prof Asen Khadzhilov

Let me dwell on some questions that I believe are of more general significance for the work of our academy, seen, to be sure, in the light of the Molecular Biology Institute to which I belong.

As you know, in recent years biotechnology has emerged, on a world scale as well as in our country, as one of the most promising lines of development in industry, agriculture and medicine. There is a contradiction to be seen here, for man has concerned himself with biotechnology ever since man began to be. But we did not start to talk about biotechnology and it was not set as a strategic goal for our science and technology until the past 5 years. The reason for this is that present-day biotechnology is based on the fundamentally new discoveries which biology has made in its various branches, and above all in molecular biology. Fundamentally new discoveries, about which, I believe, much has been said and much is known, but which--in a word--made it possible for the revolution to occur in biology that had occurred at the beginning of the century in physics and afterwards in chemistry. And this means that now we can intervene in the activity of living organisms, from the simplest bacteria to the highest organism--man.

Modern biotechnology is constructed on this foundation. And here, actually, I want to emphasize a relationship which perhaps was best expressed by Academician A. Balevski, who utters very catchy phrases. There is a catch-phrase, "Science should face the world of practice," to which Academician A. Balevski added, "It is high time the world of practice should face science." In the example of biotechnology actually we have a model of precisely this interaction. For a long time molecular biology and molecular genetics were regarded as theoretical disciplines and some people even suspected that there would never be

any benefit from these sciences. Our institute as well was criticized for engaging in very far-out matters such as nucleic acids, genes, etc. But, lo and behold! The time came when precisely this theoretical research would be the foundation of biotechnology. And I can assure the staff of the academy that the International Council on Biotechnology under the Committee for Science and Technical Progress and our institute are collaborating most closely, and we believe that, thanks to the development of precisely this fundamental research, the institute will contribute to the development of this exceptionally promising branch of our science and technology both with personnel and knowledge and specific studies.

In this light I want to support what was said in the presentation and in the report, namely, the importance of fundamental research which is not even guided, but which develops according to the logic of the science in question, whether it be physics, chemistry, biology, sociology, etc. I must say that the carrying on of this research in our country is not sufficiently well ordered. And in this connection, let me dwell on just two questions.

First, the impression is created that we are not sufficiently sensitive to the pace at which modern science is developing. Coordination with world science, and particularly coordination and cooperation with the Soviet Union, proceed very slowly. It is not often that we encounter these difficulties. But it seems to me that much more must be done in this regard. What do I have in mind? We have a plan for bilateral cooperation. It is an approved contract but, although it is imperative that our staff member go to the Soviet Union for 20 days--the research cycle simply makes it imperative that he stay there for 20 days--a reply is received that he cannot set out for more than 2 weeks. It turns out that we cannot fully implement cooperation even with the USSR. But the Soviet colleague who must come to our country regarding the same contract will come without any problems and will work in Bulgaria for 3 months.

Our academy should do everything possible to balance the rate of cooperation with the Soviet Union and cooperation at least with the socialist countries--and, it seems to me, with all developed nations--at a rate adequate for modern science. For in modern science the division of labor is becoming clearer and clearer. I believe that everybody feels this, but in molecular biology it is felt especially keenly. Plasmids, genes, labeled compounds, etc., have to be exchanged, but without cooperation and without subcontracting this cannot be achieved in one country, all the more so in a small country like ours.

Second, I must say that we fully support what was pointed out in Academician Sendov's presentation. A way must be found to subsidize fundamental research adequately. In fundamental research we now work to a great extent on the principle that "necessity is the mother of invention" since--in molecular biology at least--a subject dealt with by one to three science associates requires current expenditures of \$10,- to \$40,000 per year, whereas in our country they are on the order of 100 to 200 leva. From making the comparison you will see that for many of our fundamental research topics, at least in biology, much reliance is placed on the sharp-wittedness, inventiveness and capacity of the Bulgarian brain to catch up with world achievements. But at the same time, if the world of practice is to face science, this science has to be there. We welcome the



idea of setting up a fund under the supervision of the academy or individual centers (this is a technical matter, to be sure), which can actually subsidize at least part of the scientific research conducted at the academy, so that, given competent people who are intelligent and sharp-witted, they can carry out whatever their brain conceives.

Docent Mikhail Maleev

I want to take a position on the questions raised in today's meeting on behalf of the just-established Applied Mineralogy Institute.

The main problems which are posed for the institute are problems involving mineral raw materials and new materials. The principal tasks facing the institute involve finding new types of mineral raw materials, finding new alternative uses for conventional raw materials, and finding new materials and technologies on the basis of the specific characteristics of the mineral raw materials in which our country is rich.

In contrast to the thesis voiced heretofore that we have to cultivate intensively these lines of inquiry from which we cannot expect concrete speedy results, geological science has different specifics. It is a national science just the same with specific given subject matters and our efforts are focused on those spheres which predestinedly are our country's geological history. In this sense the subjects of our investigation are foreordained and there is no possibility of free quests as in other fields.

As regards solution of important questions involving mineral raw materials, I should like to raise two questions.

The first question is about the structural potentialities of the academy that make possible the speedy solution of important problems with applied single-mindedness. It was previously mentioned that the academy has no funds for the regrouping of forces or the financing of fundamental research. I can say that neither does the academy have funds that will make it possible to finance and stimulate any lines of inquiry from which the country expects any great results in the near future. Despite the obvious need for and importance of the research that is being done, many years had to pass and the greatest party agencies had to concern themselves with the problems of the intensive startup of raw materials, while the academy alone did not have the authority and the capability to solve this question by its own efforts and resources.

Second, in the light of the cognoscibility of mineral raw materials I should like to raise several important problems which would be priority problems for the academy and which can be solved only in the academy. I would raise the question of aluminum in our country. This problem has many aspects--presence of aluminum raw materials, knowledge of these raw materials, devising of technologies for processing these raw materials, production of aluminum-based compounds and new materials, production of monocrystals. This problem as a whole could not be solved by any organization or department in the country except the academy. And one of the impressions which is inescapable from acquaintance with the report--at least for us geologists--is that it was silent about the

one or two places where the academy made a contribution of national significance and this contribution was not that of one team, one institute or one sector, but due to the interdisciplinary character of the academy.

Likewise from the viewpoint of mineral raw materials, in addition to the aluminum problem I would raise a new problem, which arises as a result of our activity. This is the problem of optical fluoride [florid] and new materials and optical instruments which could be developed on the basis of our raw materials. I am pleased to inform you that Bulgaria has proved to be one of the few countries in the world where there is fluoride raw material for the production of monocrystals with exceptionally high characteristics. The next step--the development of technologies for cleavage [delbuka] and purification of raw materials, development of technologies for the growth of crystals--and in a year we shall produce quite a large quantity of optical monocrystals. The question then is to what extent our industry can adopt these materials and incorporate them into products, into instruments.

Prof Ivan Velinov

I take the floor with satisfaction to share my impressions of the report on the activity of the Bulgarian Academy of Sciences in 1983 because the governing body of the academy has presented to the members of the General Assembly a serious and thorough analysis of the principal results--a report to the people, to the Central Committee of the Bulgarian Communist Party and our government on the eve of the National Party Conference on Quality. For me, as scientist and academy official, this is its "White Paper," an abundant source for the publication of serious scientific findings and new evidence of the basic idea, role and significance of the Bulgarian Academy of Sciences. From this viewpoint the assessment of the report offered for our consideration must be favorable, all the more so since it is written honestly, reflecting as well the principal unsolved questions in our scientific research activity.

Following these few words about my general impression of the report, permit me to dwell on just one question and to make a few suggestions.

The question I want to talk about has to do with what new opportunities are being discovered for integration of our efforts to solve certain basic scientific and applied-scientific problems of the current national programs.

To what do I refer? In reading the report I became acquainted with a number of new findings. For example, findings in mathematics which, if applied under our geological conditions, will inevitably improve the quality of the so-called "mathematical methods" in geology. I was impressed by the research and results of the physicists on cesium and strontium sorption during the treatment of low-activity water at atomic power plants, the achievements of the Chemistry Joint Center on the synthesis, structure and properties of inorganic substances, the physical chemistry of the phase transformation and of the crystalline structure, the full utilization of fuels; the findings of the Joint Biology Center on expansion of the possibilities of using molybdenum to enhance the resistance of wheat to cold; the communication that a model has been developed by the Scientific Trust for Technical Sciences for estimating the influence of the

form, mineral composition and granulometry of the dispersed phase on the rheological and physicomachanical properties of fluid and hardened compositions, etc.; information about the qualitative and quantitative analysis of intensification relationships with raw-material and energy resources, the personnel potential and system of structural changes during the next 10-15 years of the Economics Institute.

I have selected only these examples because in addition to their general scientific significance they obviously also have significance and a place in finding new methods and means for a more rational search for and exploration of new mineral raw materials, for the creation and introduction into practice of new geotechnologies, and for the fuller extraction and utilization of the various components of nonrenewable national mineral resources.

The Bulgarian Academy of Sciences can, however, contribute significantly more, even given the presently existing resources and conditions. What do I mean? I am convinced that up to this time many of the findings in the report were known only to individual institutes, individual staffs or scientists and that the possibilities of mutual supplementation and more comprehensive solutions were not utilized to the utmost.

If one is working on problems in the sorption of radioactive cesium, it is probably not without interest to learn that, with the cesium-bearing pearlites discovered by the BAN Geological Institute, Bulgaria has become the third country in the world (after the USSR and Mongolia) that has cesium-rich rocks. For the moment, however, they have only potential value and await their "master" who will unearth our--or use available foreign--experience to extract cesium from them and introduce them into electronics, metallurgy and right up to and including medicine as a substitute for radioactive cobalt.

From the use, role and significance of molybdenum in agriculture, one cannot help but consider whether we have enough molybdenum-containing ores and to what extent we can rely on our national mineral resources and technological capabilities for using them. Of decisive significance here would be the contacts of the Geological Institute with the Committee on Geology, which is the principal organization in our country in exploration for mineral resources.

The good attempts at intra-academy integration of the Geological Institute are limited for the time being to the Mathematics Institute in the solution of the complex geothermal problems of the unique (I say this with a clear conscience) Erma River lead and zinc deposit, to the production of piezoelectric quartz crystals jointly with the Solid-State Physics Institute, and to the highly efficient development that brought a 120-million-leva economic contribution as a result of the construction of the Maritsa-2 and Maritsa-3 TETs's [thermoelectric power plants] jointly with the Geotechnics Laboratory, already within the framework of the joint center itself. These are all results with an especially encouraging element, as well as a matter, first and foremost, of good interpersonal relationships rather than normatively regulated requirements such as we expect there to be, for example, in the fulfillment of the Bulgarian Academy of Sciences' new energetics program.

Of special interest in connection with the tasks that lie ahead is the fact that the governing body of the Bulgarian Academy of Sciences has seriously and responsibly raised the question of guaranteeing the necessary conditions (I would add, all the factors) for fulfillment and overfulfillment of the task. The appeal for intensification of applied-scientific activity, towards which the academy is responsibly oriented, necessitates qualitatively different attitudes.

In conclusion, in connection with the drawing up of the new Charter of the Bulgarian Academy of Sciences and improvement of the academy's entire normative basis, I suggest, much like the approach adopted by the BCP Central Committee of wide discussion of the new Labor Code, that the draft charter of the Bulgarian Academy of Sciences be referred for preliminary discussion to at least the governing bodies of the joint centers and scientific sections of the academy. This will be not only an expression of respect for the academy's scientific personnel, but also a real step toward fuller application of the principles of democracy in one of the most democratic organizations in Bulgaria.

Prof Doko Dokov

The staff of the Bulgarian Academy of Sciences greets the National Party Conference with significant successes in scientific-research and applications activity and in the development of Bulgarian science in general. These successes are due above all to the constant assistance and guidance on the part of the BCP Central Committee and, personally, of Comrade T. Zhivkov. It is a result of the effective administrative activity of the academy's supervisory bodies and its individual sections.

The party organization, as well as the other public organizations in the academy, has also made its contribution to this. With the methods and means characteristic of each of these organizations, the party organization, the trade-union organization and the Komsomol worked much more effectively during the past year to mobilize scientific staffs and assisted the scientific leadership to overfulfill scientific-research and science-applications plans, as well as the pledges of staffs to intensify scientific research, to raise the quality level of scientific labor, to increase academy participation in the development of the economy and to improve the system of social administration, as well as to solve the problem of quality in all social spheres and our participation in the international division of scientific-research labor within the framework of the socialist camp.

The successes in the work of party and other public organizations in the BAN in rendering assistance to the scientific leadership, although they have been considerable, cannot and must not make us complacent. There are several reasons for such a statement.

First, the objective possibilities today are much greater than the results, which means that the optimum possible level has not been attained.

Second, the requirements and tasks, set by party and country for the scientific front, of reaching the world level and providing the most effective scientific

services to the economy and other social spheres, have not, despite the successes, been accomplished to the utmost.

Third, these requirements are constantly growing, and what is more at an ever greater rate, which is due in turn to the influence of the scientific and technical revolution and to the international division of labor and integration among the socialist countries.

One of the important, but still unaccomplished tasks facing the public organizations in the academy, as well as the governing scientific bodies of sections and departments, is the improvement of discipline. The point at issue is wider understanding and raising of the problem of scientific-production, technological, administrative and financial discipline, the fulfillment of planned tasks and assumed pledges, and the efficient use of scientific instruments and physical plant.

Despite unquestionable successes in strengthening discipline in most academic sections, the question has not been completely solved. There are many potential reserves. Many weaknesses are tolerated. We suggest that the governing body of the academy, jointly with the Administrative Party Committee and the governing bodies of other public organizations, discuss in a special session the state of discipline in the academy and take the necessary measures for its further strengthening in the spirit of party precepts.

Another question on which I should like to fix the attention of the General Assembly has to do with the wrong attitude toward the internal funds of scientific sections, accumulated as a residue from applications activity carried on through unplanned contracts. In recent years it has become standing practice during the drawing up and approval of the academy's budget at the Ministry of Finance to include these monies, with a reduction of the budget subsidy to the institute in question. The result is a paradox--the scientific section that has exhibited greater initiative, has operated better and has had a greater applications effect receives a smaller budget subsidy; its financial resources are restricted. There are examples in this regard in individual joint centers, especially in the Physics and Biology Joint Centers. Such an approach violates the fundamental principle of the distribution of goods under socialism, "To each according to his contribution." Here the opposite happens--he who makes a smaller contribution gets much more, while from him who makes a greater contribution, what he himself has earned is taken away. In this way the personal interest of the scientific sections in expanding applications activity is lessened. This question is alarming, for in the report we make comparisons year by year, from which it can be seen that in recent years we have already had a decline in applications activity.

Permit me, lastly, to assure the members of the General Assembly and the governing body of the BAN that the public organizations in the academy will increase their contribution to the accomplishment of the great strategic tasks which the National Party Conference has assigned to Bulgarian science, and more especially to the Bulgarian Academy of Sciences.

Academician Yovcho Yovchev

The report to the annual meeting which the BAN Presidium has drawn up is, to be sure, well compiled from the perspective of my approach. As it happens, I should like to make only a few remarks about the questions with which I am to some degree familiar.

Now that we are on the threshold of the holding of the National Party Conference on Quality, problems involving the quality of our work should become acute. What do I have in mind? First, the report points out some achievements of the Geology Institute which I do not regard as achievements. I am amazed how it can say that, on the basis of the comprehensive, revisory mineralogical-petrological, geochemical and structural investigations of zones with quartz-adular mineralization that developed in the volcanoes of the Eastern Rhodope paleo-genic depression, the metallogenic significance of adularization for the search for and exploration of auriferous and polymetallic mineralization is proved. These are known data. We have explored this zone for 34 years. Huge sums have been expended. The problem of gold arises now. And since few people are well grounded, everybody attempts to concern himself with this, always avoiding the economic portion of the question. We should seek what application there is for all of this rather than make a geochemical approach. I suggest that this portion of the report be corrected.

Second, I would request that the Academy's Economics Institute concern itself more actively with the questions of the realities of effectiveness when they emerge in one form or another. When there is talk of scientific achievements and their effectiveness, their economic content should be assessed. Without economic content, we can spin innumerable theories, but theories of no use.

For the past 15 years we have been concerned with the inorganic composition of the coal strata in the country. I have investigated about 18 fields with thousands of specimens. I have concerned myself also with the inorganic composition of schists. I have determined the quantitative and qualitative indicators of 20-50 elements for each stratum, for each sector. For these fields everything is calculated in detail--about 40 volumes of research. Where, for all that, is the question? The question is in the economic status of this research. Without technology and value, we cannot determine the use of it.

Choline analysis is one of several methods by which coal strata are identified. The field that was explored 5 years ago had a great quantity of reserves at a depth from 1300 to 1700 m. I am referring to the Dobrudzha field. Four years ago, on the basis of the chemical analysis that I made, I found that there are still many reserves of coking coal.

During work on the Dobrudzha field in the past 4 years and on conclusion of the basic groups of research, the following was found: the water in the coal fields contains many interesting components. For example, in working 6.5 million tons of reserves a year, about 1 million tons of pure salt are obtained. Among the other components we have strontium, etc.

Moreover, as a result of 2-year research the following was found: there are reserves, probably all of which are coking coal, on the meridian from Kavarna



to Obrochishte and to Albena, south of the contours of the field. Later on drilling was to continue in the sea. This was done first on [Cape] Kaliakra, where we drilled to great depths--3700 m. Drilling was also conducted in the shelf and it yielded many strata of splendid coal. For the present we have reached 10 km offshore.

In conclusion, I want to say again, let us be more precise in our formulations, for tomorrow we shall render an accounting.

#### Concluding Address of Academician Angel Balevski

Our academy is a very old institution. To be sure, it has existed in its present form since the years following the April Plenum.

There is a great difference between the academy as it was created 115 years ago and the academy as it is now. But nevertheless, during all that time it has lived a scientific life. And here traditions have built up, a well-defined atmosphere has been created. One could hardly deny that the academy has its own atmosphere, an academic atmosphere which we exert efforts to maintain.

A great deal has been done to define and stabilize the scientific policy of the BAN. You know that years ago an important document, "Strategy and Tectics of the Scientific Policy of the Bulgarian Academy of Sciences," was published.

To be sure, things change and the academy cannot stay in the same place. It must develop and change continuously with the changes in the present-day world. It is not an institution which develops by leaps and bounds and in which things are thrown into confusion.

A great deal has been done to guide the creative thought of scientists toward fields and activities which make possible the wisest use of the academy's scientific potential.

I am far from contending that everything is done along these lines. Nor could everything be. It will be quite a long time before--not everything, but anything-- is done that may to a certain extent satisfy us.

Here is a case in point. Comrade Velinov mentioned that he has now learned from the report about the devising of certain mathematical methods which may very well help geologists. Unfortunately this is a fact, a very sad fact. I make so bold as to confess that there is not enough in-house information in the BAN, but it is difficult to create such in-house information in the academy, to know what is happening in the individual sections. I have mentioned it many times. I decided to share this in conversation with Hermann Klare and Jaroslav Kozesnik, chairmen of the academies of sciences of the GDR and Czechoslovakia. Not to seek methods that have been developed elsewhere, not to seek procedures that have been developed elsewhere. But they told me that the situation was the same in their academies. It turns out that it is easier to obtain information from the outside. The individual scientist working in his field knows what is happening worldwide, but does not know what is happening in another institute or in the academy. We will try, we will make efforts

to set up a modern system of current information. But, in final analysis, the use of the General Assembly is to see what work is being done in the individual institutes of the academy and to see what the achievements and results are. These results will be made available for use "to the benefit of the Bulgarian people," on the one hand and, on the other, people will become better and better acquainted. Thus the main thing that gives strength to academic thought is brought about.

I have said many times that the BAN's strength is in its scientists, in its institutes. This is very well, but its true strength is in its interdisciplinary character. In our times there is no problem--no interesting, important problem in a complex and modern society--that is not interdisciplinary and that can be solved homogeneously by a single institute or even by two or three. Usually many institutes are engaged--indeed so many diverse institutes that anyone marvels how their activity could be correlated so as to serve one common goal.

Now that many things in the academy are regulated and pursue their own natural course, the question is to create the most purposeful organizational structure possible so as to make optimal use of the BAN's potential.

You know that the academy's activity is implemented through contacts with the ministries. We have contacts with all ministries that turn out production. We have also set up a very good system of contacts with the okrugs. All this, to be sure, is unquestionably very good. And we shall continue to do it. We have regional programs. There is much talk about Strandzha-Sakar, but ever since 1954 there has existed, unless I am mistaken, a BAN program called "Strandzha-Sakar," which indicates that the academy has always shown interest in this area. And now that the conference on this question has been held, you know that most of the data were provided by the academy, and most of the reports likewise were presented by the academy. To be sure, we do not imagine that with the numbers and the resources that we have we will gain access everywhere and solve all problems, but there are some matters that only the academy will solve.

Very often, however, a situation like this arises. Let us take, for example, a huge organization dealing in minerals. Naturally when there begins to be talk about the huge sums constituting turnover, when there is talk of exports, foreign exchange, etc., i.e., things which are of exceptional importance for our economy, what the academy does, so to speak, becomes invisible. For what the academy does is small and is measured in petty sums. It is measured in thousandths of what the outlay of these big organizations is, but there are things which these organizations cannot and will not be able to do. These things can be done solely and only in the academy.

What directions must the academy's activity take from now on? Two directions--service of the present (which is being done) and provision for the future. These must be the two directions of the academy. And the great art, which must be the task of all, is always to seek and to find the right balance, namely, the balanced ratio that tallies with the given moment and its needs.

Should more effort be cast into the service of the present or more effort allotted to the creation of the future? That is what has to be correctly proportioned.



The academy must very watchfully keep track of the development of our present-day world and adapt to its needs.

As for service of the present, a sufficiently satisfactory system has not yet been set up for effecting the application of the academy's achievements. True, there are statistics which trace how many out of how many inventions are introduced into production and what they show is encouraging. I believe, as does everybody, that the more the level of our industry, of our economy in general, is elevated, the more in demand our academy will be. This is beyond all doubt and this process is already observable.

Another encouraging process is also observable. Of the scientific achievements that are introduced, the achievements of Bulgarian science, so to speak, have the preponderance. I have in mind not only the academy, but the whole country in general, as compared with what we get from abroad. This is a high stage, which shows that we are already deploying the nation's own forces--something which is exceptionally important.

But the next higher stage will be different and in a certain sense will be at variance with the present stage. This will happen when our production rises to such a level it is in our interest to pay to get licenses without losing time, to get foreign achievement with the realization that we have sufficient scientific potential to match it and ensure its continuous development, that we have the capabilities to produce at such a high quality level as to compete with whomever we got the license from.

These are stages through which we must pass. Yet we have passed the stage when we had no need of science, when we could use only foreign science because we did not have our own. Now we are using our science more and more.

But I repeat again, this is not the highest stage. The highest stage, which is a sign of a developed economy, of developed industry, will come when we can take the best achievement from the outside without neglecting our own, and have the resources--productive and scientific--so that we will be competitive with those from whom we have got something without making any effort or have bought it.

You know that at Plovdiv a branch has been set up, which actually is an entire institute but is called an Applied Physics Laboratory. There people have begun to make things that we did not have hitherto, which the country lacks. They have created photothyristors which are at a very high standard. Negotiations are already under way at the moment with the National Association regarding the setting up of a small plant to produce these sensors and other parts.

Why emphasize this? Because here we are touching on an exceptionally important question--can we make large machines, can we strive to highly perfected manufacturing processes, for which, of course, automation facilities are needed, but we lack many elements? We lack resources for creating the most highly perfected instruments. Many things are embargoed. At the academy we must make it our goal to pursue a counterembargo scientific policy. Many things that we cannot get abroad we must produce here ourselves.

Comrade Maleev, for example, mentioned crystals; the reference was to aluminum. Now the aluminum is aluminum as metal, a very important metal. I would wish that we in Bulgaria had a great deal of aluminum because we have the ability to process it by a most highly perfected method and the state would benefit from it. We should export it. But we do not have aluminum as a metal; however, aluminum is also used in the form of compounds, which in many cases are of greater importance than the pure metal.

Things expand their spectrum with the result that what earlier was a nonmetal-liferous mineral, some kind of earth or rock, now takes on very great significance and arouses great interest on the part of modern technology. We must concern ourselves with such questions so as to solve the problems of our industry.

The academy may not be able to make a sewing machine. That is something our industry can make, but the needle only the academy can make.

This is an exceptionally important question and we must weigh it carefully. We are making efforts to create the academy's own facilities. What policy are we pursuing in this regard? When instruments are created in the institutes, when new materials are created--something that will be an object of production--should we have the opportunity to produce it? Or should we produce it in zero series, create the technology and transfer it to industry if it is a large-scale extended production process?

Many times I have concerned myself with a question and looked at it with the eyes of an engineer. For example, the biological sciences. People make experiments, investigate something. They get the idea of combining several elements in such a way that they find a quantity they could not find before. This is very important--a unique, very interesting instrument, apparatus is created. But it is not a commercial commodity. There have to be engineers to reconstruct it, simplify it, create a design for it, create the production technology; then it can be an object of production.

But all these things must pass through the academy, must be done in our facilities. Unfortunately, we still do not have enough such facilities, but we are endeavoring to create them. In Plovdiv, for example, a very splendid facility, very well equipped with machinery, is being created. An old tobacco warehouse is being reconditioned at a very rapid rate in order to become an entire little plant for scientific instruments. The KAMAK system is likewise being produced at Plovdiv. We already export many such systems to the Soviet Union and other countries. In all, BAN exports are already in excess of millions.

But this is not what is most important. What is most important is to be able to do things which make us as economically independent as possible and not to be under the threat of the embargo policy which the Americans are pursuing towards us.

As for the component base, as for scientific instrument- and apparatus-making, we still have quite a few problems. There is one very big gap we must close. Our obligation is to contribute our share in solving a problem which affects the entire socialist camp. But, on the other hand, we have purely national interests

here too, which we must defend. Earlier when specializations were divided up, our country got the following: the Germans kept clear of anything series-produced and gave it to us, but they grabbed at things where there was labor-intensiveness and high science, where great training was required and which paid the most. When you make an original instrument, people do not ask what it costs but whether you will give it to them. Moreover, when something moves serially along the conveyor, it is hard to compete with those who have been making it for many years. Therefore we must aim toward items of ever finer quality.

When we make things in which we have invested our intellectual national patrimony, our skills and our know-how, when we make them better than others do, they will think twice before running the risk of failures of first production, of the "childhood diseases," etc., of a production process if they can get it from us. And that is for certain a force in our hands, our weapon.

Teamwork is needed in which one side will be the BAN and the Committee for Science and Technical Progress, and the other the ministries and social task-setters concerned, who will want us to decide certain more complex questions so that we can define the questions and formulate them so that they are suitable for the academy. The BAN's scientific potential must not be wasted on industrial-combine work or on trifles. There are many institutes in the country and they must serve industry, but the academy must shoulder ever more important and substantial tasks.

Difficulties also exist in publicizing our achievements. In the academy we have a very great weakness, for which I too am greatly to blame, but I have always felt uncomfortable in thinking only that we must tell what the academy is doing, must publicize it and show it to the world. But this is obviously not just a question of praise. It is a way of showing people what we have so that they will use it. In this regard we have not done enough.

As for the exports of BAN achievements and the corresponding imports that we need, we cannot do this through the counterpart foreign trade trusts--for them this is not of the slightest interest. Say, for example, half a kilogram of some reagent, while they deal in tons.

We cannot sell our books. Why? Because there are many more interesting things for the Hemus organization which is engaged in book exports. Again, in order to export scientific literature, scientists are needed who will tell what this literature contains, what it offers. And we are constantly filling up buildings and rooms with books, with literature, about which we are constantly getting questions and requests, because there is nobody to send it out.

The Medical Academy, for example, has solved this question. And we are on the way to solving it with the setting up of BANIMPEX. In final analysis, it seems that when something is specific, whoever created it should have a look at it and he can suggest to the customer why he needs it and what job it will do for him, whether it will get the job done he expects of it.

Mention has been made here of biotechnologies, which are of exceptionally important interest. You know that an association has been set up which will have great funds at its disposal. But the work here must be assigned very wisely so that everybody will assume that share of it which corresponds to his training. There are things which, here too, only the academy can do.

As for provision for the future, Comrade T. Zhivkov has spoken many times about fundamental research. Fundamental research is very important. We must not, to be sure, exalt ourselves to the high heavens, divorce ourselves from the practical world, cease to be interested in it and say that we practice only great science, that we practice only high science, that we do only fundamental research, because even if we want to, for many reasons we cannot. One of the reasons is that in our times there is no achievement of fundamental research that does not find application at once in practice. A striking example in this regard is the laser. At the time Hertz discovered laser waves, he was asked whether this discovery would have any application. He laughed and replied that it was a hypothetical phenomenon. But can we now imagine the world without radio waves! After the laser was discovered, it rapidly made its way into innumerable spheres--both medicine and fine production processes, everywhere and anywhere.

So, when science is conducted at a high level, there is no reason to "worry about the customers," i.e., to worry about how we will sell it--a way will be found. The more the practical world develops, the greater need there will be for fundamental science. We must allot a great portion of the academy's scientific potential and scientific thought precisely to provision for the future stores of the Bulgarian nation. This is a very important question.

In many cases we work on a special commission. I would say that anybody coming to Rome sees that Bernini adorned it with all sorts of sculptures. The Sistine Chapel is painted by Michelangelo in inimitable fashion, but there were Maecenases then. There were Maecenases for science, there were Maecenases also for art, and that is why they flourished in the past. Now we are a country growing richer from day to day. We are creating an industry that is profitable, but what do we need this money for? Shall we bury it in a jar or form capital or what? Our country will with the passage of time become a powerful Maecenas of science, of culture, of public health and education. This will perhaps be the greatest concern of the state. And speaking candidly to you, I would agree that everything the academy produces which may be worth tens of millions should go into the state budget, but the people should be well paid. It should be known that the state rewards the people it respects, that it prizes their labor. This labor will be well paid, and they for their part have a moral obligation to the people and the state that prize them, and when something interesting, something good is done, additional remuneration will, of course, be received.

This question was raised orally in the Council of Ministers and a document is now being drawn up which will include a proposal to set up a fund in the academy so that the Presidium itself can assign tasks. These commissions will not be of such a nature as to meet any concrete needs of industry, but will be wisely weighed commissions for things which should be our intellectual patrimony, our nation's patrimony. Developments which we shall need tomorrow.

We must be able to keep track of what work is being done anywhere in the world and in what direction the much in-demand scientific thought of man is channelled, and if we can do much in this regard, at least one group should be employed; and whenever anything is achieved in the area in question, we must be able to use it, for it can be used only by people who are abreast of the New, who are up to a high level.

We can have a calm conscience--the reproach cannot be leveled at us that the academy is a parasitic enterprise. These 520 million leva will be exceeded nearly twofold during the 5-year plan. This shows that whatever the state gives us will be exceeded twofold. But that is not the important thing. What is more important is that we give our nation things which it did not have and could not have had earlier, that we consider carefully the fact that the level of our people, of our economy, of our culture is being elevated and they will require scientific services at an ever higher level, that we must have a secure future, a bank of skills that will be ours, for when a person can do something, when a person knows more than others, he holds a great power in his hands. And we must put such power into the hands of the people.

A very important problem exists. The academy must have one door for both entrance and exit. But now there are many doors and in many places the fence is breached, there are many holes and nobody knows who is entering, what is coming in and what is leaving.

It is an exceptionally bad thing that some department, for example, sends for people from the academy and entrusts them with an order to produce something, after which it gives them a gratuity. Wherever we see it, it is degrading for the people, diverts them from their specific job and corrupts them. The Bulgarian Academy of Sciences must not be a profiteering enterprise and must not be the eyes of scientists to look for profits. They must think about their science.

When something comes into the academy, I have in mind the giving of an order, it must come in through the main entrance and when it leaves, it must be given a form that bears the guarantee of the academy, rather than that of an individual.

I do not want to mention departments which have summoned scientists from the academy, paid them and then announced that scientific studies had been made. And where are the scientists? They are nowhere to be found. This is the way scientific thought is squandered, and people in the academy are demoralized and diverted from their principal problems. In this respect the BAN must have one entrance and one exit. And everything must be checked. Once a work leaves the academy, it must bear the academy's mark.

A sore matter for the BAN is the physical plant. Recently Academician Sendov and I were in Moscow. We were shown some tables and I copied down some items.

The Academy of Sciences of the Soviet Union has assets of 116 million rubles per scientist. The Tadzhik Academy, which is newer, has 17 million rubles, while our academy has 11,500 leva per scientist. Reassessment of this fact is now

beginning since in final analysis all apparatuses are depreciable. If the depreciation allowances are recalculated, we shall see that we have 5,- to 6,000 leva per scientist. It must be admitted that however intelligent we may be, however inspired we may be, which cannot be disputed in any event, without funds we still cannot match anybody.

I want to raise another question. Do you know that we are in the Teachers Trade Union? There are statistics which show that the highest morbidity is in the Bulgarian Academy of Sciences. I think that Academician Maleev is familiar in detail with this question. In some positions there is also latent morbidity--these are positions where work is done on experimental animals and people are not always guaranteed that they will not be infected with some disease. This is especially unwholesome. This situation is tolerated just the same, but it should not be. Living standards must be guaranteed. In the BAN we have over 800 families which are extremely needy. We have scientists who are living under inhuman conditions. Means must be created for these people. Can a person in this situation think about a job and about science? Obviously we cannot ask such sacrifices from everybody.

Lastly, I want to say a few words in support of what Professor Yolov said at the outset about the social and humanitarian sciences. I shall speak from the perspective of an engineer who sees a factory, who sees in the factory the marvelous machinery with which intelligent and capable people are working and very conscientiously turning out defective products without being bothered. These same people, questioned in a setting predisposing to frankness, can give you a brilliant lecture about the fact that in a socialist society there is complete agreement between public and private interest, etc. Why, then, is such a person not working as he should? Why is he producing less and lower-quality output? Has this question been investigated? Our socioeconomic system surely does not predispose to such an attitude, does it? Just the opposite! At least theoretically it should be just the opposite. Yet why does this happen? You see, it is a question of the man, the production man.

People cannot be shifted to another workplace in production. Why does this happen? What is the matter with sharing? Do they have levels with a common boundary? When joint work on one project was done and boundaries were abolished, we said that people no longer had any reason to study to become lawyers, for the boundary which was the basic source of disputes had disappeared. But it appears that life is much more complex. And all these things are a question of interrelationships, relationships between people, relationships between man and man, between man and society, relations in private life, relation between man, society and collective under working conditions. Many, many and extremely many questions where special laws are operative, and Comrade Zhvkov has stressed this many times. There are objectively operative laws that we cannot go against. We must study them and comply with them, for unless we comply with the laws, they will knock us on the head.

To be sure, the academy faces many problems. And many of these reduce to better organization. We have weaknesses in the BAN Central Administration, for example, which consist in our separating the scientific management from the

purely administrative. And scientists not only in the central governing body, but also in the joint centers and elsewhere are engaged in activities which are atypical of scientists, for which they are not suited, which are not close to their heart, and they have the feeling they are wasting their time on them.

We must set up a structure in which there are people who have a knowledge of administration and can run the academy economically, while the scientists who are in the governing body should actually be a scientific governing body.

All these things can be seen, of course. Anybody who thinks that the governing body does not see them is mistaken, but these are problems that are very difficult to solve.

We know that every organism grows and this is an irreversible process. I have never believed in explosions. I have always believed in processes. Therefore, the point is that we should bring about conditions under which the processes will flow in a direction that is advantageous for us and of benefit to our people.

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STATE OF ARABLE LAND, EROSION, SOIL QUALITY ASSESSED

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[Article by Prof Ivan Gurbuchev and senior scientific associate Mikho Yolevski: "Bulgarian Land and Soil Resources and the Tasks for Soil Science to the Year 2000 and Beyond"]

[Text] In his earlier and even fairly recent development, man has thought of the earth as limitless, but with his first attempts in agriculture he confronted the problem of the depletion of soil fertility. Thus the immediate, practical reaction was to exchange the used land for new land, and later, with the relative growth in population, he turned to periodic "rest" for the land that had already been used. With the appearance of commodity production, land took on value and became an object of private ownership. Independently of this, mankind all over the globe continued for a long time to consider the earth's resources to be limitless.

Just after the Second World War and especially after the Stockholm International Conference, held under the aegis of the United Nations in 1972, the problem of rapidly dwindling and nonrenewable natural resources, which required international as well as national attention, was added to the list of problems concerning the preservation of the environment, together with the earth's other natural resources.

Soil science and the various aspects related to it--landscape science, geomorphology, geochemistry--all appeared in the 19th century, when the great Russian scientist and naturalist V.V. Dokuchayev began to lecture about a new subject in the 1960's. "Soil Science," to the students of the Higher Agricultural Academy in Novaya Aleksandriya, now called Pulawy, which lay within the borders of today's Polish People's Republic. As we know, Prof Dokuchayev wrote a number of fundamental works until his death at the end of the 19th century: these works have become the basis for today's world soil science.

In the 20th century soil science became one of the main subjects of agronomic education and became widespread in social and economic practice in the more developed countries.

In the last few years, in fulfilling the Stockholm Declaration, the United Nations' program for preserving the environment elaborated a worldwide soil policy, the principle positions of which were adopted by the Management



Council of the Program at its regular session in 1982. A single plan for preserving and renewing global land and soil resources is now being worked out in fulfillment of these principles. The world soil policy and the plan for its realization have become the subject of a separate article.

In connection with this theme, it would be of interest to offer some data in regard to the world's land resources 10 years after the Stockholm Conference.

#### The Dynamics of World Land and Soil Resources

Very detailed information about global land and soil resources is found in world literature on this topic, as is data on the earth's losses caused by natural and anthropogenic factors, the diminution of the soil's fertility, the potential possibilities for reclaiming new lands, etc. However, it must be pointed out that there is still no single, uniform international information system for the dynamics and condition of the earth's land and soil resources. Recently, within the framework of the world soil policy, the methodology and criteria for a single international information system for constantly following quantitative and qualitative changes in the world's land and soil resources have begun to be developed. It turns out that in order to reach that goal, we need a single international soil classification system, a single method for evaluating land and soil productivity, as well as international agreement about the level of information and other preconditions. Without the preliminary resolution of these problems, obtaining reliable information will be impossible, because the figures with which we work today can be considered only approximate.

It is assumed that the land resources in the world today are around 13-14 billion hectares, of which 1.4 billion hectares are cultivated, that is, 10.6 percent. About 3 billion hectares are used for pasturage and harvesting hay, 4 billion hectares are used for woods, etc. It is thought that at the present-day level of science and technology, the possibilities for reclaiming new land are around 3 billion hectares.

It must not be forgotten, however, that under the influence of growing populations on certain continents, such as Africa and Southeast Asia, weaker, less suitable lands, with poor soil cover and the presence of a number of limiting factors, will be reclaimed for agricultural purposes.

At the same time, it is estimated that the annual losses in arable land are around 10-12 million hectares, that is, as much as the whole territory of the Bulgarian People's Republic. It is thought that the losses due to erosion are around 3 million hectares, to pollution 1.5 to 2 million hectares, and to removal of the land from agricultural purposes 6 million hectares. It is estimated that around 50 percent are totally losing their productivity, that is, 5-6 million hectares, and the others are

losing their productivity to one degree or another. Based on these data, the following prognosis for changes in the relationship between population and natural resources has been made:

1975	population	4 billion
	all cultivated land	1.4 billion hectares
	per capita	0.35 hectares
1975-2000	losses in earth:	
	for agriculture	300 million hectares
	becoming worse	300 million hectares
	reclaiming new land	300 million hectares
2000	population (avg. est.)	6.253 billion
	cultivated land	940 million hectares
	per capita	0.15 hectares

These data are truly approximate, but they express the very clear basic tendencies and support the necessity for an agreed-upon world policy for limiting the losses of productive land, as well as the necessity for national and international measures to improve the existing land and reclaimed new land, especially in regions where solar energy resources are great.

#### The Dynamics of Land and Soil Resources in the Bulgarian People's Republic

Despite the fact that it is small in size and population, without a doubt the Bulgarian People's Republic occupies a significant place in the production of agricultural products in its specialization and the distribution of labor within the framework of CEMA, and in certain regards, beyond the limits of CEMA.

Thanks to its geographical location and its very favorable agroclimatic resources, the Bulgarian People's Republic will not lose its significance in the future. Agricultural production plays a decisive role in the total economy and resources balance of the country. International prognoses clearly show that produce problems will continue to become acute in the next 20-30 years, and the prices for agricultural products will increase.

In 1982, agricultural production here, without any industrial processing of the raw agricultural products, obtained 18-20 percent for pure production, 24 percent for the needed work force, 30 percent for export, and 30 percent for commodity funds, according to the report of the National Agroindustrial Union in 1982. If we keep in mind what was said above the international tendencies, there is no room for doubt that the significance of the land and soil as a national treasure must remain in the focus of the party and state policy of terms of the economy, technology, science, and lawmaking. Among the number of private and social problems,

first place belongs to the questions of preserving, rationally utilizing and renewing the national land and soil resources. It is not accidental that in 1982 the State Council of the Bulgarian People's Republic issued a special document: "Fundamental Requirements for the Development of Agriculture in the Bulgarian People's Republic," in which are outlined the nation's ecological policy for agriculture, the approaches for improving the productivity of agrosystems, preserving the earth and managing the natural aspects of agricultural production. The timeliness of this document is shown by the presence of a number of unfavorable tendencies in the balance of land worked, the increase in erosion, and in certain cases of debasing the soil fertility.

In 1981, there were about 7 decares of arable land per capita, that is, including meadows and pasture, and about 4-5 decares of cultivated land. The total amount of arable land was assumed to be 61 million decares, and of cultivated land 46.5 million decares. In comparison with 1975, the arable land has decreased by about 170,000 decares, and cultivated land by nearly 800,000 decares. During the same period, around 120,000 decares of land were being reclaimed, though the National Agroindustrial Union does not give any information about the quality. These figures show unmistakably that the reserve of the more productive cultivated land is decreasing, probably because, on the one hand, of the allotment of land for nonagricultural purposes, and on the other hand as a result of the degradation of the lands which are shifted to the category of pasturage or to the woodland fund.

Despite the presence of state documents to forbid it, significant plots of land are taken up by populations and industrial sites annually, chiefly for ore output. There are documents which require the restoration of the land destroyed by industry and construction, including the rational utilization of the humus layer of soils for creating new land. Yet the data show that the restoration is not conducted according to amount or quality. Of 300,000 decares of destroyed land which are waiting to be restored, up to now only 50,000 decares have been, and half of that to woodland planting, when the norm has a maximum of 15 percent. These data demonstrate that the restoration is of poor quality and below what was expected in regard to amount. Especially alarming is the situation in the Eastern Maritsa lignite extraction rayon, where first-class land is being destroyed. Of the 100,000 decares destroyed here, only 18,000 decares have been restored, 7,000 for agriculture and the rest for woodland. The picture at the L.I. Brezhnev Construction and Installation Combine and the G. Dimitrov Economic Mining and Power Complex is the same. These facts show that there can hardly be any talk of the actual restoration of destroyed areas. They also show that laws and technical regulations are not being obeyed. It seems from everything that it is necessary to renovate the legislative process and the entire technical policy with a view toward not permitting any room for deviation from the state documents.

Another, more serious problem is erosion. In spite of the National Program, which was adopted quite a while ago, great changes have not come about in overcoming the reasons for water erosion. What is more, the preconditions for wind erosion have appeared here, and this is something we have not had before. The technical-economic conditions for complying with the National Program have already been worked out, but work on designing and planning for compliance with the program has not yet begun. If measures for the future are not taken in time, it is thought that around 40,000 to 50,000 decares of land will be removed annually from the fund of cultivated land as a result of erosion.

In terms of soil mapping studies, our nation ranks among the top in the world. These studies show that very significant reserves exist for improving the qualitative structure of the national land and soil resources through transforming the land funds and the types of agricultural crops. This question is now being raised in a number of countries and international organizations. Mapping studies here show that over 1 million decares of meadows occupy lands of the first through third classes. In the north-eastern rayons of the country, 1.5 to 2 million decares of first-class land are occupied by unproductive woodland on level ground, while in the same rayons cultivated land is found on sloping terrain and geologically old gullies. The sensitivity with which the forest-agricultural institutions here greet this question when it is raised is well known, but it is evident that we are dealing here not with provisional, departmental matters, but with national interests. This does not mean, however, indiscriminately turning wooded land into agricultural land, but working out a scientifically based plan in accordance with the topographic and soil maps on the 1:10,000 and 1:5,000 scales, as well as a long-lasting technical-economic program (25-30 years) which will be realized systematically, through regular planning. It is obvious that now is the time to raise this question with the appropriate scientific and design institutes, so that preliminary elaborations can be discussed at the rayon and national levels by specialists at the institutes and in departments.

Another question which needs to be reexamined is the introduction of a land cadaster. The question is about its perfection and practical utilization. There will be time in the future for speaking about its scientific perfection. In the practical regard, it must give detailed information about the dynamics of land and soil resources and the realization of average and annual land utilization.

#### A Qualitative Characterization of Our Soil Cover and the Tasks That Face Soil Science

As with other small countries in the world, Bulgaria has a detailed soil map on the 1:25,000 scale, and for 25 to 30 million decares, a map at the 1:10,000 scale, which gives extremely detailed information about the qualitative structure of the soil cover. In addition to this, after the well-known Bulgarian-Soviet soil expedition in 1947, much physical, chemical, and biological soil research was conducted; this research offers a wealth of information about the fertility of soil in Bulgaria.

Speaking generally about the soil, our country is divided into three areas: northern Bulgarian, which is covered mainly by black earth and gray woodland soil; the mountainous area, which has brown clayey and mountain-meadow soil; and southern Bulgaria, which has clayey, maroon soil. Based on agroproduction traits, they are classified into 11 agrosoil groups. Generally speaking, the most favorable kinds of soils are the black earth, followed by the clayey, meadowland, dark gray woodland soils, and others. Those with the least favorable characteristics include the gray, some of the maroon and brown podzolic soils, and others. Our soils are classified according to their (presumed) genetic origin, and the land is categorized as a means of production according to a relative index of productivity in relation to the basic crops in the rayon. These classifications have their merits, but neither of them gives a sufficient parametric concept of the soil's growing qualities as an element of the given agroecosystem. Although the studies that have been done here with this goal in mind are not numerous, up to now they have not been used for a quantitative characterization of soil productivity. The question of how much detail is advisable in order to distinguish differences in the nation's soils for practical purposes still has not been resolved.

Independently of the lack of directly comparable indicators of productivity, our scientific study of soil and land up to now, as well as traditional experience, permit the soils to be categorized according to fertility and productivity.

As we said above, cultivated land here now amounts to about 46.5 million decares. Based on information up to now, we can say that around 22 to 25 million decares of this total have optimal traits for nourishing the basic crops of the rayon. The remaining land, which has soil variety, needs some type of improvement, to one degree or another, whether through territorial organization, fighting erosion, drainage, adding gypsum, adding lime, improvement in regard to air and water, indigenous-inhabitable space, nutrient regimen, elimination of toxicity, etc. It is thought that 30 percent of the territory in our country is not suitable for agricultural use, without revealing the reasons or making an analysis of the scientific-technical and economic levels needed to be able to eliminate the drawbacks of larger or smaller parts of these areas.

The object of special programs, design resolutions, capital investment, and material-technical concern for basic improvement is the so-called poorly productive land, which takes up about 15 million decares of the agricultural land, soil that is eroded, overirrigated, acidic, alkaline.

There have been positive cases, but in the history of man's agriculture there are many more negative examples of turning bountiful regions into deserts. Such examples on a large scale are unfortunately not exceptional even today; this is the case with the huge Amazon Valley.

From what has been stated above, we see that a number of problems are facing our soil science, which according to our point of view could be formulated most generally in the following way:

--Analyzing and communicating current scientific research here and abroad and applying it, in an integrated way, to improve "defective" soil, through experimenting on optimal production scales.

--Beginning more diligent scientific research in areas where there are gaps or lags that have been identified, with a view toward resolving them in a specified time.

--Formulating technologies applicable to the year 2000 and beyond, according to their technical and economic feasibility and advisability, based on the new results obtained from scientific research and production experimentation.

--With a view toward operative management of production, in collaboration with institutes in the various fields elaborating soil correction factors for practical use that will decrease the unfavorable influence of uncontrollable growth conditions in 10-day periods of the vegetation season for the most important crops in the nation.

In light of the problems formulated above for the period up to and beyond the year 2000, the following problems have arisen to confront our soil science:

1. Maximal practical utilization of our own and foreign achievements for improving "defective" soils in our country. In order to solve this problem, experiments and scientific research must be carried out, as a first step, on the production scale. From what has been said above about the quality characteristics of the soil cover in the country, it follows that production experiments must be started on heavy black earth in northwestern Bulgaria, and with lightly carbonated black earth, which contains from 3.5 to 15 percent carbonates, on light gray pseudopodzolic soils, brown, maroon pseudopodzolic soils, and also with clayey soils.

According to information today, heavy black earth soils must be tested with technologies that employ periodic crumbling, surface drainage, deep maintenance of moisture, chemical means with long-lasting influence in the structure and the water permeability.

With carbonated black earth soils, the shortcomings are noted in the physical, and partly chemical, water characteristics. One of the approaches could be modern spray irrigation with a simultaneous influence on the chemical traits with substances distributed in small quantities in the irrigation water during the most important vegetation period. Micro-processors and sensors for feedback must be used for the correct regulation of the watering regimen, as well as for the dosing of the chemicals. In addition to this, we must test the more easily accessible approaches, such as the maximal recycling of organic wastes, types of mulching, minimal cultivation, etc.

With light gray, pseudopodzolic, woodland soils, one must begin first of all with territorial organization, as well as surface drainage, leveling, and deep moisture preservation as the basis for constant, elementary water

maintenance. Together with this, means and devices for regulating the air system, the soil reaction, supply of phosphorus and potassium and certain microelements, land use methods, mulching, minimal cultivation, etc., must be tested.

With pseudopodzolic, maroon, woodland soils in the country's southern rayons, we should try the same technologies as with the light gray woodland soils, as we keep in mind the differences in the quantitative relation.

With brown woodland soils, the problem is mainly due to the chemical regulation of fertility and effective land use methods. The technologies must differentiate between meadows and pasturage and potato production. Adding lime is the most effective chemical treatment, but because of the difficulties with applying it in mountain rayons, one must seek small-sized meliorations, such as partially decomposed phosphorites of the SFF 60/40 type, organophosphates, chylates, etc.

With maroon soils, one must begin first of all with certain new systems that have had effective application in the semidry tropics, such as the so-called broad-preparation furrowed surface with constant and periodic arrangement. This system permits the economic utilization of energy based on the unique traits of these soils for self-leaching. Essentially this is related to the system for minimal cultivation, specifically for maroon soils.

The production testing must be carried out under the guidance of scientific institutes, specialists, and implementers of the mutual agreement institutes, specialists, and implementers of the mutual agreement principle with the agroindustrial complex, with a view toward compensation for possible losses, and also with a view toward precise reporting of the economic effect. The experience we have already accumulated in our country with similar methods shows that in most cases additional profits are realized, not losses. This approach to implementing scientific achievements through adaptation is used by the international organizations of the United Nations in rendering assistance to the developing countries.

2. Modeling the productivity of the agroecosystems in the nation. The development of quantitative models for the realization of maximal productivity in the agroecosystems, differentiated on the basis of natural and socioeconomic conditions in the various geographical rayons, represents a major problem for agricultural science. Here we find a place for soil science as well as other agronomical sciences. The differentiation of agroecosystems must come about through a mathematical-statistical elaboration of the corresponding information for the microclimate, lay of the land, soil, water, air, vegetation, socioeconomic, and social preconditions. The number of agroecosystems in the country must be the result of the mathematical-statistical differences between single integral indicators, such as biomass, energy, contribution to the national product, and income on a national scale, etc. The approach to differentiating various agroecosystems is covered to a great extent by the



approach to economic appraisal of the land. The agroecosystem, however, is a territorial category with indicators that are unique in the country, that is, it cannot be duplicated within its borders. In other words, the agroecosystems are differentiated on the basis of the quantitative evaluation of the conditions for the production of agricultural foodstuffs and raw materials, of their integration and differentiation. This new elaboration will offer information for the perfection of the cadaster now being introduced, respective of its utilization for the operative management of production and the annual evaluation of the realization of the ecological potential of the agroecosystems. From a number of indicators, we will obtain the optimal seasonal indices for 10-day periods to determine the quantitative interrelationship among the technologies, natural phenomena, and the social organization of production. Technologies in contemporary agriculture create strong interference in the natural reproduction and equalizing processes. From this point of view, constant quantitative measurement of the changes in the agroecosystems has great significance. For this goal, it is necessary to work out a methodology, criteria, and an operating system. Quantitative changes in the agroecosystems heavily influence the effectiveness of social labor, the balance of resources, and the country's economy.

There is no doubt that the basic elaboration and the monitoring itself will be carried out with the aid of computer technology.

3. Models of soil fertility. According to an improved genetic classification system for soils in this country, there are now over 300 types of soil. For practical purposes, however, they are united in 11 agroproduction groups and 34 subgroups. What has already been done in this regard is useful, but before putting together the models we must decide on the advisable number of them. For this purpose, the basic soil data must be worked out systematically for soil differences on the scales of 1:25,000 or 1:10,000. In other words, this means the data from the cartographic studies, accompanied by standard soil analysis, in order to subject them to a regression analysis of the organization of the demonstrated differences between the soils, that is, the number of models. In such a case, the possibility is not excluded that one model could contain distantly related genetic soil names, such as the subunits of gray and maroon woodland soils, clayey, heavy black earth, etc. It is time, as in other developed countries, for our soil science to move to totally quantitative diagnostic indicators. This does not mean that we must ignore past and present processes or that we do not have to perfect the genetic soil classification systems based on the principles set out by Dokuchayev and his followers. But we will construct a more profound scientific basis for making prognoses of the tendencies in the changes of soils as positive or negative in relation to the production purpose, influenced by human activity.

The next step in modeling must be determining the quantity variations in the model: mechanical structure, organic substance, water regimen, air phases, relative and bulk weight, chemical and biological traits, etc. For this goal, it is certain that there will have to be new scientific

research on characterizing the soil traits, which act as growing factors. The research will probably have to be conducted according to standard methodology for each soil marker and also in a number of cases under tightly controlled conditions. After completing the first pass at modeling, the possibility will be created for experimental production plots to be used for testing the second, improved generation of technologies.

The model must have a static as well as a dynamic state. The static state must encompass the maximal values of the structural traits under average ecological conditions. The dynamic state has to encompass the possible varying values of the traits under conditions that deviate from the optimum, including the technological devices for maximal support of the balanced state of the model.

In order for the models of soil fertility to be used in practice, each model must contain accessible methods and technical means for keeping track of the variations of its parameters under production conditions, which would be introduced by computer, for making the necessary decision.

There is no doubt that working out the necessary number of models for Bulgarian soils and developing the technologies for their support in production practice will require research work at a high scientific level. This would be within the powers of trained soil science cadres in close collaboration with specialists from other scientific disciplines, such as mathematics, chemistry, biology, physics, etc.

4. Research on compensation for unfavorable natural phenomena. It was mentioned earlier that the dynamic state of the model must support the methods for regulating its parameters when deviating from optimal natural conditions in the production process. Deviations could come in the form of aridity, low temperature, low irradiation, light, etc. Actually, this trend could be developed only with the collaboration of soil science, plant growing, agrometeorology, selection and genetics, and protection of plant growth, etc. Soil science must play its own part, which is sufficiently large, since a significant number of controlled growing factors fall under its area of competence.

For now it is not necessary to enumerate the details, but for the sake of general orientation we could mention regulation of the soil surface, the relationship between the fluid, solid, and gaseous phases, the relationship between the macro- and microelements, the biological interference, etc. Scientific research in this regard must be planned purposefully in time, at the national level.

5. Cultivation of the soil, mineral fertilization, crop rotation. Despite the fact that soil cultivation, mineral and organic fertilization, and crop rotation are an important, basic part of the dynamic state of the model of soil fertility, it is advisable to dwell especially on them. They represent the most accessible methods for regulating soil fertility and intensive research work needs to be conducted on them.

Cultivation of the soil. From the above-mentioned principle approach to modeling for soil fertility differences, it follows logically that the systems for soil cultivation in the agroecological rayons cannot be the same. Perhaps we have to recall that in the recent past in our agricultural science and practice there were "waves" of deep and shallow plowing, soil pits, and so forth. At the present time, some scientific workers rashly propose minimal cultivation or a system of no cultivation at all. From the point of view of theoretical and applied soil science, this approach cannot be the correct one, since the same approach cannot give the necessary result under different conditions. The information we have accumulated here on soil cultivation is not insignificant and must be communicated attentively, and if it turns out to be necessary, more experimenting should be done. The necessary optimal physical conditions for soil fertility are maintained by cultivation. Let us take the clayey soils as an example. The soil traits we already know about evidently exclude continued minimal cultivation or lack of cultivation. If, however, the system of broad-preparation furrows mentioned above is applied and maintains the self-leaching layer of clayey soils intact, it might be possible for minimal cultivation to have a place in this soil type. In the country's southern rayons, where the vegetational period is longer, if this technology is successfully applied and supplemented with spray irrigation, sowing and laying the pipes together with the harvest of seed crops, this will without a doubt guarantee the possibility of obtaining two full crops.

In other words, the technologies should be the result of dialectically connected methods and reasons.

Mineral fertilization. It has been repeated many times that fertilization must be optimal, based on a concrete chemical analysis of the need for fertilization, etc. What is more, blind fertilization can lead to increased cost of production, to polluting the environment, to producing low-quality products, etc.

Soil analysis has been carried out all over the world, and here as well, for more than 25 years, to determine the quantity of mineral fertilizers injected into the soil. Periodically, every 5 years, communicating the results by country offers valuable information on the coming soil changes. The last report was made in 1980. As with the earlier ones, it showed that 95-98 percent of the soils were poor in nitrogen, in an amount equal for almost all agrosol types. This fact gives rise, however, to a justified question of what the soil analysis demonstrates generally with regard to nitrogen and if the supply of nitrogen to the plant is in fact so meager. It is known that most of the countries in the world do not conduct soil analysis for nitrogen. We shall introduce one example directly tied to this question. In order to check the supposition that the agrochemical analysis which is now being used does not indicate an adequate state of nitrogen in the soil, an experiment was used over the course of 20 years near Sofia with the norms and proportions of nitrogen, phosphorus, and potassium on clayey soil. After 20 years of constant fertilization, it was halted for 1 year. The so-called zero parcels were divided into parts

for introducing 8 and 12 kilograms of nitrogen per decare. After harvesting the wheat, it turned out that the parcels which had been fertilized with nitrogen for 20 years gave the same size crops, even after stopping the nitrogen for a whole year, as the parcels which were fertilized with only 12 kilograms of nitrogen, with equal amounts of phosphorus and potassium, in the 21st year. In other words, as a result of 20 years of fertilization, the clayey soil had acquired the trait of supplying around 12 kilograms of nitrogen, without this type of fertilization, at the same time that the soil analysis continued to show that it was "soil lacking in nitrogen." Unfortunately, such checks were not made on other soils and in other rayons.

In regard to phosphorus, the reports indicate that the amount of remaining phosphates as a result of fertilizing grows constantly. The category of soil with poorly preserved phosphorus has shrunk from 65 to 58 percent, and average maintenance has grown from 22 to 27 percent. As before, the soils poorest in phosphorus are the gray woodland soils, and the richest are the black earth and clayey soils. In regard to potassium, because of the insignificant use of potassium fertilizers, the soils with poorly maintained potassium have increased from 5 to 6 percent. As could be expected, the tendency for change in soil acidity is not favorable. For example, in Plovdiv Okrug the soils with strong acidic reaction have increased from 9 to 18 percent, in Pazardzhik Okrug from 0.7 to 7.5 percent, and so forth. These results require a reorientation of the methods for research on the fertilizing needs of the soil, as well as the practice of fertilizing, the assortments of fertilizers, etc.

In many countries, instead of determining the quantity of nitrogen in the soil, models are constructed for the capability of certain soils to generate nitrogen during the crop vegetation, that is, they do not analyze the soil for nitrogen. In regard to phosphorus and potassium, modern scientific information is already offering the possibility, instead of periodic analysis of the soil's state, of following the "referative" (rating) plots and, based on precise data, giving annual recommendations for production. This is not possible to put into effect in countries with thousands of small farms, but it is fully possible and economically feasible in our country, where we have a unique socialist organization and land use policy. This approach would serve production and would give new, precise information for perfecting scientific methodology. Recommendations for the use of mineral and organic fertilizers must be closely tied to cadastral information with a view toward operative technological management of production.

Putting into practice agrochemical research and serving agricultural production in this way are expected to lead to economy of mineral fertilizer, to the creation of at least a 1-year supply of mineral fertilizer, which in turn will increase its effectiveness even more, due to its timely use.

Crop rotation. A very large number of experiments on crop rotation are known to have been conducted in the world, some of them continuing for 130-140 years. Many experiments have also been carried out here.

Generally speaking, under equal conditions it has been established that rotation has irreplaceable significance for certain crops or groups of crops, such as grains, with a fused surface. At the same time practice and experiments show that with a high level of technology and applying special measures, it is possible for wheat to be repeated without decreasing the harvest. It is known that the structure of the sowing area here requires the repetition of a significant percentage of grain crops. In connection with this, the question arises of which variant causes the most crop loss, wheat after wheat or wheat after corn sowed late, which is done in practice because of meteorological conditions.

A dogmatic approach to crop rotation with the agricultural crops of today is unfounded. The duty of agricultural science is to develop more perfected technologies for the conditions of our country, with a view toward maximal avoidance of unfavorable effects of repetition or lengthy continuance of grain crop after grain crop. Such an experiment has been conducted for over 25 years now by the Wheat Institute in Dobrudzha, and it was founded by one of the authors. This experiment must be studied more profoundly, since it seems to be the only one in the country.

In this regard, a new series of studies are being applied, as a more perfected approach and better technical-biological means are being used.

In addition to the fundamental problems mentioned above that face Bulgarian soil science up to and beyond the year 2000, there are many production problems, which must logically find their place in the systematic development of themes and methodologies.

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From the brief exposition made in this article, one can see that soil science and the methods and achievements associated with it for serving our socialist agriculture will take on more importance in the future development and economy of the nation. After 1985, according to the United Nations criteria, our nation will join the ranks of developed nations. This is indisputably a high honor for the Bulgarian people, but also a responsibility in the international community. This means greater responsibility as well for agricultural science and production because of the international meaning of the production problem. In connection with this, it is necessary to take a critical look at our own activity in science and production, in the training of cadres and the possibilities for rendering scientific-technical assistance to developing nations in the area of soil science, land reclamation, and agriculture. Soil science, agroecology, and agricultural science as a whole must actively contribute to more rapid economic development and growth in the political prestige of our socialist country on the international scene.

In the present article we have tried to explain the necessity of reorienting our soil science to a new, higher level in the light of new knowledge in this field and the international trends in scientific and political life. We do not feel that the problems have been fully exhausted. They are quite complex and require sober, detailed discussion by scientific and production cadres, so that by the year 2000 our native land can be at the height of development foreseen by the plans of our party and government.

12334

CSO: 2202/7

ULTRASONIC VIBRATION WELDING EQUIPMENT DEVELOPED

East Berlin BERLINER ZEITUNG in German 3-4 Nov 84 p 3

[Article by Dr Reinhard Fiedler, engineer, Institute for Communication Engineering]

[Text] "Wherever the increase in work productivity is a matter of concern, the work pace of Berlin must be a trademark for the whole republic," said Erich Honecker at the 15th Conference of District Delegates of the SED in Berlin. This means for the capital in which about 20 percent of the entire research potential of the GDR is concentrated to meet this claim itself in its enterprises and institutions: More productivity with Berlin pace. The prime objective is the shortening of the transition times of new products, to make investments more rapidly effective, and to achieve top performances in the quality of production and reduction of costs. We want to bring some examples and experiences in this regard in a series of contributions. Today, Dr Reinhard Fiedler, engineer from the Institute for Communication Engineering in Berlin will point out how the gaining of time in research and development is leading to substantially higher productivity in the production of consumer goods at the important Berlin enterprise Elektro-Apparate-Werke Treptow.

Welding With Ultrasonics

This modern technology for the uniting of plastic parts uses friction heat for welding. With a frequency of 20 kcps (20,000 oscillations per second) the surface in the contact area becomes soft and both parts are fused together under the effect of pressure within fractions of a second. The ultrasonic tool itself remains cold in the process. The high technological cost makes the use of such installations rewarding only with high production unit numbers.



To employ scientific-technical top performances within the shortest possible time effectively in the production process--that is what I understand under Berlin's pace. It demands, however, that every researcher and developer abandon his customary work methods with the objective of enlarging the economical yield of scientific-technical work. Most of all, it is necessary to further state out the field of our responsibilities and therefore to consider our task of development as finished only when the new product has proven its worth in practical application.

To declare oneself for such a responsibility is one thing, but the four of truth comes only when the matter reaches the stage of realization. It tolled for us when the EAW Combine asked us to speed up the development of a new efficient 1000 watt ultrasonic welding facility.

Our research center (it belongs to the Communication Electronics Combine) is the only facility in the GDR developing complete equipment for the ultrasonic welding of plastic parts. This modern technology plays an increasing role especially in the rationalization of assembly processes.

#### An Especially Urgent Order

The advantages: Compared to conventional processes it makes possible increases in productivity of up to 500 percent, along with a substantially higher quality of the products. It is economical in the consumption of materials and energy. It improves the working conditions. Our "Ultrasound Plastic Welding" collective, which has researchers, designers and rationalization engineers among its members, has supported to date over 50 enterprises in the introduction of this technology. So far, so good.

However, there were urgent reasons for the EAW order: The serial production of a new product had started in the Treptow plant, namely of an advanced portable radio, equipped, with a digital clock. However, the existing technology, the glueing of parts for the speakers and time display into the front plate proved to be an Achilles heel: Insufficient strength, excessive cost. One can easily imagine that high reject rates counteract directly the objective to deliver this year still as many radios as possible to the trade.

Moreover, our situation was not simple either. We were still in the middle of the development work. The 1000 watt facility was a tough nut to crack for us, in spite of all the experiences made with similar sets. We were faced constantly with new problems and findings which had to be taken into account in the design. Should we make our first welding plant of this new type immediately available for a serial production of consumer goods? Some of us thought this was too great a risk.

We therefore had to make a decision--to choose either the safe time schedule determined by experimental values which allowed 10 months for the supplying of the test sample with a subsequent test run of several weeks, or a pre-schedule completion full of risks with immediate production effectiveness.

We decided in favor of the latter, and for several reasons. To provide more and better consumer goods is a first-rate economic and political task. We had our clear standpoint. Now, when we had to prove it in practice, none could or wanted to back out. Secondly, the preferred start of production and the knowledge to be gained by it would benefit us in the research center for the further development of the series production facility. This, too, was a valid argument.

However, we, as well as the EAW, took a considerable risk. Even with the best planning one cannot foresee every little detail, but it was perhaps precisely that which challenged the ambition of all developers and our allies in the shop of the institute.

We wanted to prove that we could develop top-notch products based on our engineering and technology, products determining the international state in the field of ultrasonic welding. This motive, which in the final analysis was political, was a powerful incentive for all of us. In addition, there was another consideration: We are a Berlin Research Center. Don't we, therefore, have a special obligation to bring out strength to bear on the side of the capital city's industry?

It was demonstrated that even complicated situations can be mastered with such incentives. Some material problems had to be taken care of in 1 or 2 days, which might otherwise have taken weeks. Additional production capacities had to be opened up quickly. In all these situations an experienced collective, firmly welded together in the course of time, proved its worth once more, as did the fine collaboration with our partners at the EAW.

The scientific-technical level of the new welding plant which is supported by two patents has proven its production maturity. Since the beginning of September, colleagues from the EAW have manufactured under laboratory conditions in our research center several thousand radio housing parts--of substantially better quality and with a far higher productivity than before. Science and production have therefore come into very close contact.

The economic effect is clear: With the old glueing technology a workmate could produce 80 or at most 100 parts a day. With the new welding technology we are manufacturing today 500 to 600 parts! While the skilled workers of EAW are manufacturing with our operational sample, the "real" welding plant earmarked for their enterprise is under construction in an adjoining room.

It will be delivered by November 30--3 months ahead of time. The experiences gathered in our enterprise by the workers from EAW in the new technology can help them to use the installation from the day of delivery with high productivity in the manufacture of radios without a long run-in period.

All this confirms the accuracy of our decision. It has paid to assume the risk.

12693  
CSO: 2302/51

DEVELOPMENTS IN PROSTAGLANDIN PRODUCTION NOTED

Budapest MAGYAR HIREK in Hungarian No 22, 27 Oct 84 p 10

/Article by Istvan Palugyai: "The Hungarian Prostaglandin"/

/Excerpts/ Hungary has played a very substantial role in prostaglandin research from the very beginning; moreover, to this day, Hungary has retained its leading place. Csaba Szantay, academician, professor and chairman of the Organic Chemistry Department of the Technical University of Budapest, was questioned by me about the beginnings of the prostaglandin career.

"The story began more than 50 years ago when two gynecologists in New York made an interesting discovery. They noted that human seminal fluid produces a strong contraction of the uterine muscles. On further research they found that this effect is due to the fatty acids present in the semen. The active ingredients, their chemical structure still unknown at the time, were named prostaglandins although it was found later that, instead of the "suspected involvement" of the prostate because of the name, these compounds are produced within the seminal vesicle. However, the name has stuck to these substances which actively affect nearly every part of the organism. Today the chemical structure of prostaglandins (several groups are involved) and their mode of action in the living organisms are known, of course. Using a semisyntetic biochemical method, these compounds were first produced in 1964 simultaneously at several places in the world. Prostaglandins synthesized using purely chemical methods appeared in 1970 on the world market. In the same year, we started to bring about the domestic, industrial synthesis of the compounds in a joint effort with the experts of the Chinoin Pharmaceutical House. The efforts were successful and, 2 years later, the first milligram of Hungarian prostaglandin was ready. In 1974 production was started on an experimental industrial scale and thereby Chinoin became the third company to market the product commercially, after Upjohn in the United States and Ono in Japan. By now more than 100 natural compounds, formed in the organism, and more than 10,000 synthetic derivatives have been produced in the laboratories, and new articles about prostaglandins are appearing daily from the scientific laboratories around the world. The process gained new impetus with the discovery of prostacyclin in 1976, a compound chemically very closely related to prostaglandins, which is produced by the cells forming the inner wall of blood vessels.

"Globally, some four-five significant laboratories are working on this topic and we are among them. In our department, we are currently engaged in making the very labile prostacyclin more stable. We want to alter the molecular structure in such a way so as not to lower the clotting-inhibitory capacity of the compound. It could be one of the realistic goals of domestic research to market such a compound within the foreseeable future. We are also engaged in the production of prostaglandin-like synthetic compounds, the so-called prostanoids. These can be used in doses lower than the natural compound to achieve the desirable effect. At the university, we work on the basis of research assignments from Chinoin, and the more than 10-year process has gained appropriate ranking through numerous patents. Several Hungarian scientists have achieved international success in this field. For instance, Istvan Szekely of Chinoin coauthored the United States paper reporting the production of the first synthetic prostacyclin. Currently 15-20 scientists are working on prostaglandins in Hungary."

In 1976, Chinoin's registered prostaglandin preparation appeared on the market. Gabor Kovacs, head of the pharmaco-chemical section of the pharmaceutical house provided some explanations concerning the economic background:

"Up until the first half of the 1970's, the annual production of the Hungarian pharmaceutical industry was frequently increased by 16-20 percent. This period was the age of reproductive research involving alternate methods of producing compounds already introduced, known and protected in the West, and mostly their export to socialist countries. However, in the 1970's--with the increased economic interactions between East and West--this strategy became disturbing to the large Western partner enterprises. At the same time, there also was an increased need in the Hungarian economy for income produced by exports of this branch to the West. We had to prepare for the production of original drugs. Since Hungarian pharmaceutical research is traditionally stronger on the chemical side, attention was directed toward the syntheses requiring greater chemical preparedness.

"Our product named Enzaprost, which is the first prostaglandin produced in Europe, was a great victory. The synthesis worked out by the pool of scientists at Chinoin is the least costly of all currently known methods....

"We produce it in the order of magnitude of 10 kg annually, in tablet and spray forms, and the amount represents about one-fifth of the world's prostglandin production. This year we expect to see our new plant completed where we will be able to produce as much as several 100 kg of prostaglandin. Ninety percent of the drug is used by veterinarians; because, in human medicine, in aborting pregnancies more than 4-5 weeks old, some side effects still have to be reckoned with--although they can be medically inhibited.

"Because of the very inexpensive synthesis, the Chinoin product is also competitive on the world market. However--and this is well known in the factory--we can only hope to maintain this competitiveness through strenuous further research producing new synthetic prostaglandins with more favorable effects than the natural ones."

PROBLEMS, DIFFICULTIES IN ROBOTIZATION PROGRAM DESCRIBED

Warsaw PRZEGLAD TECHNICZNY in Polish No 37, 9 Sep 84 pp 11-13

[Interview with Dr Andrzej Dubina, head of the Developmental Enterprises Department of the Institute for the Establishment of Mechanical Industries, by Agnieszka Wroblewska: "Only Coercion Can Save Us"]

[Text] [Question] A lack of people for work compounded by poor productivity directs our hopes toward robots and automation. The term "robotization," which is used eagerly today not only in the technical world but also by politicians in society, suggests that we are really on the trail of this process. Robotization appears to be the panacea for delays.

[Answer] A panacea, as my friend has said. I hope that the readers of PRZEGLAD TECHNICZNY are not so naive as to believe in miracles. And miraculous is what we would call a situation in which robots appear suddenly, on a massive scale, given the current state of industry.

[Question] Is it because we are technically lacking or because we are mentally unprepared?

[Answer] First, second, and third, it's not always worth it.

[Question] Let's begin with the technology.

[Answer] We have several hundred robots of different types installed in the nation's industries. Industrial robots are the normal means of automation, and it is important to remember this because, for certain laymen, this term evokes images of factory workshops filled with workers of metal and not workers of flesh and blood. The robots and robot arms used in Poland are devices which are much less complicated technically than many, e.g., numerically programmed machine tools. Robots are not a novelty in the technical sense. They are, however, thanks to the possibility of the complete elimination of live workers, an organizational novelty.

Two years ago a team of workers from our institute prepared a report on the topic of the introduction of robots in a couple of business offices of the machine industry. The report simply does not tell why robots do not rule industry more dynamically; however, the analysis of the examples researched has clarified several sources of technical-organizational weaknesses.

The Passenger Car Factory [FSO] had at that time (2 years ago) installed 17 foreign robots and 5 of Polish manufacture, applied to the production of the Polonez. The robotization plans of the 1970's were than significantly broader, but they have not been realized--a lack of means and a decrease in the production of automobiles were not considered in the plans. The Polonez was to be developed, the production was to grow to 140,000 annually. As a result of difficulties in the import of materials and elements the production of the Polonez amounted to about 60,000, and in following years it decreased by almost half that amount. American robots installed in the chassis production lines in the best year, 1980, when the production of the Polonez amounted to 60,000, were in use for only about 30 percent of the basic work time. Robots in the painting booth experienced difficulties--there was damage and fouling in the nozzles. Therefore, the foreman of the paint shop stationed a worker there; in spite of the strong fumes, he personally completed the work intended for robots. The actual work time of these robots amounted to about 20 percent of the base time. The use of Polish-produced robots was similar. Plants for the production of telephone equipment used three robots of Polish manufacture. The plans for their application were imposed on the plants from above; they were, however, received favorably and with high hopes. All three robots were to be placed in a single production cell. In this way, three persons working at the presses served by the robots could be replaced by one worker observing the cell. Over two shifts this would mean a savings of four workers. However, the first robot was bought in 1978, the next a year later; then they were installed in a fashion other than that originally planned, and the original conception fell by the wayside. It is necessary to add that the number of robots purchased was low; this caused additional difficulties with regard to their introduction. A robot would work well for a year and a half, after which it would break down. During the down time it turned out that a worker (without violating the safety regulations) could take out and replace the core of the instrument mounted on the press in the space of 8 seconds, whereas the robot required 11 seconds for this same task. Now workers who had the opportunity to service the press during the down time of robot took advantage of the time allotted to the task.

A different situation obtained in the Mera plants. There they tested the installation of five robots of Polish manufacture. The program of robotization was imposed on this establishment at the end of the 1970's, and it was not eagerly welcomed by the management. The workers had low qualifications for this; there were many trained workers, for the range of products was not being changed. An experienced worker has an understandable distaste for servicing complicated devices. As a result, tasks related to introduction are generally neglected. One of the robots, for example, had two parts for assembly--a bushing had to be inserted into the lift--and already by the time of the experiment it turned out that the bushings often had to be patched; this resulted from the inaccurate machining of the part. The worker who performed this operation had to fit the parts personally before inserting them onto the press.

[Question] What results from these examples? They are not consoling, and one could expect the conclusion that it is not important how much the planners racked their brains over automation if manual reality wins in this way.

[Answer] The first conclusion is this: robots ought to be introduced with sense; the decisions ought to be the responsibility of the same establishments which saw a need for their use. Any advance is effective only if it is accomplished in a natural and evolved manner. Sometimes, for example, computers are installed but they forget about ... rats. And rats gnaw through the cables under the floor, for certain types of fixtures are tasty. I think that generally the situation is better with the use of robots than with the use of computers. Besides the abortive uses, there are successful ones. For example, in the enameled machine factory in Olkusz, a robot was installed for the application of enamel, and for a couple of years it has been working with great success. The best results are given by the installation of robots as integral parts of production lines, units, or devices, and when their introduction occurs at the same time these devices are put into operation. It is also good when they are introduced into select divisions of establishments having an efficient technical base, which will facilitate qualitative exploitation. It is also more useful to apply them to operations which in general cannot be accomplished by people (on account of their burdensome nature, their difficulty, their harmfulness, or the like), or to organize the robot's workplace so as to make access by people difficult. The devices working with the robot must be efficient and infallible. Before the assembly of the robot, it is necessary to analyze their infallibility.

[Question] Do you consider that we are in a position to satisfy the industrial needs for robots by our national efforts? In a word, is it possible to introduce robotization "in Polish"?

[Answer] I think that we have a sufficiently numerous engineering and technical cadre to meet those demands. As a matter of fact, the demands continue to be low. Polish procedural robots are good. In any case, it is easier to construct the robot than the devices which go along with it. Thus, some of the devices should be bought on the world market. The movements of precision instruments must be controlled with great accuracy, and, during the course of a year, we could make only 15-17 of the complex robots which could replace such precision instruments. But robot arms which could replace machine tools could be manufactured by the hundreds in the space of a year. If only establishments really wanted it done ...

[Question] Then shall we move on to the mental resistance?

[Answer] If there is mental resistance, then that means that there are economic reasons, and they must be examined. Let us consider what inclines establishments to introduce automation and what inclines them to reject it.

The basic factor is people. The robot frees us from difficulties involved in obtaining workers, and, as we know, this is a headache which is felt everywhere.



The lack of people, and in particular of hard workers; the quantity has fallen again by several percent. Since in the last year 1 worker in 40 fell victim to a registered accident, considerations of safety speak out for robots. After all, extensive methods of management win out in practice. Warsaw factories are already penetrating the suburbs of Mlawa in search of a work force, the countryside is scoured clean, but it is still better to count on the transportation of the third daughter of a small-hold farmer than to turn to revolutionary technology. Transportation is still cheaper. They give you the limit for gasoline, so why not transport them? I tell you that in the majority of establishments they have not yet seen a really painful lack of people for work, and the worsening quantity of goods produced is not a really painful worry for them. But in those places that really cannot find another way out, for example in Diora in Dzierzoniow, where they had been holding out, they have been building robots for themselves. A lack of competition in the marketplace is also a factor in the reluctance to push technology forward. In those places where competition appears, for example in export production, establishments are expressing a greater interest in robots. This also occurs in those places where there is foreign cooperation, or where stringent collection requirements are enforced for other reasons.

[Question] In a word, there must be economic coercion. One cannot count on the awareness of the work force or the resolution of the management to change the instruments of production.

[Answer] If the introduction of robots were imposed from above, we would be throwing billions down the drain. If what prevailed was fashion, display of contemporary style, then the result would be similar. But we can imagine the government's central decisionmakers taking steps to require that establishments improve technology. For example, a drastic increase in the costs of employment for each newly-hired worker would influence them to seek salvation in robots.

[Question] We have come in this manner to profitability. Your view that necessity is the mother of invention appeals to me very much.

[Answer] Even more: I think that the more brutal the necessity is for a man, the more readily will he act, take risks, and think.

Nobody would lift a finger for himself if he didn't have to. Investment is troublesome, costly. You have to get the money, fight for the procurement of the necessary machinery, then come troubles with labor and getting replacement parts, etc. One way or another, people always manage to land on their feet. In the Museum of Agriculture in Ciechanowiec, I once saw an exhibit on the farm machinery industry. Factories appeared after the abolition of serfdom.

The liberated serf began buying tools. Formerly, in spite of the fact that the more enlightened nobility called for the development of the trades,

for the broadening of progress in the cultivation of farms, nothing happened. This same enlightened nobility knew that enfranchisement is an indispensable condition of progress; however, few enough of them could bring themselves to give land away freely. This is perhaps a remote analogy, but it is an example of the fact that economic coercion forms the basis of technological progress.

[Question] But will robots here be generally profitable? Perhaps the game will not be worth the candle? For our industry is so debilitated, I would even say fundamentally so, that perhaps there is no sense in turning to progress which cannot be seen.

[Answer] There is no other way out. Since we have built an industry, it must more or less conform to the required level; where else can we go, except to return to conventional manufacturing? And really, the estimates of efficiency could not work out any better. The robot, along with the installation, will cost approximately 8-15,000,000 zloty. The return of the cost should be realized in the course of 5-6 years. And it will be earned back more than once in the course of a decade. But let us remember how it will be earned. The share of payment for labor in the cost of products is 2-10 percent. This does not take into account such initial costs as the training of workers in the factory, the construction of housing for the increased work force, etc. And it would be reduced to such a trifle that no one would ever again want to undertake dirty, stinking, or very tiring work.

[Question] Automation makes sense when, in the place of thousands of parts, you can produce millions. And then, it is important to consider the cost of progress. In our establishments we know how it is--a lack of raw materials even for those thousands. Should we pay out money so that afterwards the robots would stand still for most of the day, as do the robots at the Polonez factory?

[Answer] But not introducing them is to be condemned to incessant shortfalls, to a crippling degree, as a result of the high costs of production. I would like to remark in conclusion that two positive facts have finally appeared. There are establishments which are trying to extend their technical frontiers reasonably and are constructing robot arms for their own use. Moreover, there have appeared establishments which are asking us of their own free will, to perform an analysis and to advise them on the question of the purchase of robots. This is happening chiefly in factories where the average pay is low, and even the third daughter of the small-hold farmer would not be tempted.

[Question] We must then wish for further coercive situations. Thank you for the interview.

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